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PC NETWORK

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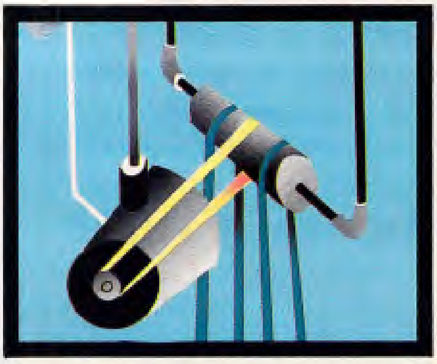

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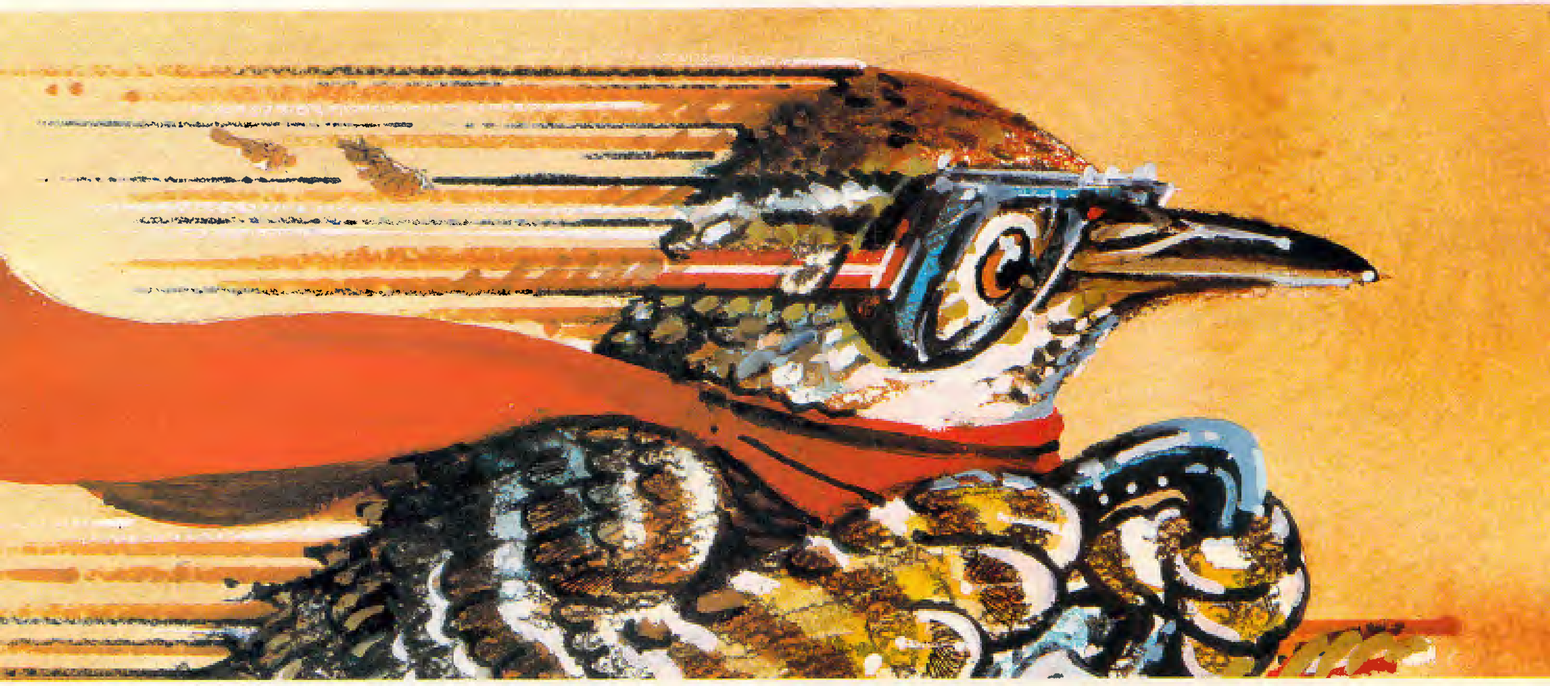

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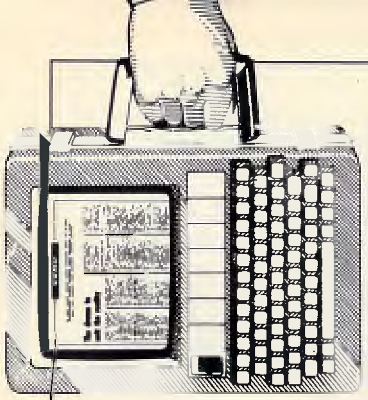


There's news of laptops from IBM, a dBASE IV announcement from Ashton-Tate, Taiwanese PS/2 clones and — at long last — Steve Jobs' innovative personal computer. And that's only for starters.

Making silk purses from sows' ears

The arrival of a single plug-in card with an Intel 80386 chip in it has transformed a heap of junk in the back of a store into the most sought-after piece of hardware around. Total cost? Just under $2000, plus whatever value you put on your old PC.

The 'piece of junk' is the original IBM PC, now celebrating its fifth birthday in Australia. (It's older than that in the US, of course.)

The card is the Intel-produced Inboard 386, which fits inside the original PC and replaces the slow, old 8088 chip. The effect is astonishing, and not just in speed terms.

The bad news is that it's only speed you get. The card doesn't (yet) have available a version of OS/2 that will work on it, nor yet a version of Windows/386; Intel hopes to have these available after May. "We're working on it," the company promised.

In speed terms, the old PC is one of the least impressive machines on the market. With the 386 brain transplant, a rough workload Benchmark put it ahead of a 12MHz 286 — even using the disk, which rather surprised me until I noticed that I'd been using an ultra-fast Priam RLL drive.

What really surprised me, however, was how the machine appeared to its owner, a computer dealer. I rang him up to borrow it for the test. "Have you got an old PC, genuine original?" I asked. "Oh, yes," he replied vaguely, "one or two that don't work properly and we can't bother to have fixed. I'm afraid it's useless. It's one of the original PCs, you know, with 16k on the motherboard, and a cassette port, and only five slots."

It turned out that the 'fault' was a colour monitor set to conflict with a monochrome monitor, and removal of the mono card fixed that.

The machine actually requires you take out the 8088 chip. A short cable connects the board into the old chip slot, which means it will only fit into machines where the chip is in exactly the same place relative to the slots — the IBM PC and XT, and the original Compaq, apparently. You can't change the cable because its length is crucial to the timing of the signals.

After running my tests, I showed the machine to its owner. His eyes widened progressively during the demo of how easy it was to fit; and, at the end, he suddenly found that he wanted it back, "just to try out one or two things. Oh, and could I borrow the Intel board for a week?"

He has one problem: shortage of slots. With the Inboard in one, a floppy disk drive and a display card, there is no room for things like a clock if you want a serial port and a hard disk — unless you buy multi-function cards.

Most multi-function cards for the PC include added memory. The Intel Inboard includes 1Mbyte of its own, fast 32-bit memory, and it ignores all the PC's own memory entirely.

So, a new multi-function card has to be provided. My

Setting new records for both graphics resolution and retail price, the $4850 NEC Multisynch XL is the latest addition to the successful NEC Multisynch range of monitors. With a resolution of 1024 pixels wide by 768 pixels deep, the 20in monitor is every power user's dream screen.

The Multisynch XL will be launched at PC '88 in Sydney, along with the Multisynch Plus (with a meagre 960 by 720 resolution) and the even more down-market Multisynch II (with an eye-straining 800 by 760 resolution). All of the new Multisynch monitors are compatible with IBM's VGA display standard (640 by 480 resolution), along with EGA, MCGA, PGC, and just about everything else. They can also be driven by Apple's Macintosh II.

The top-end Multisynch XL can adjust itself to all horizontal frequencies between 21.8KHz to 50KHz and, like the other models in the range, carries a two-year limited warranty.

friend was last seen on the tracks of an IdeAssociates card which does both floppy and hard disks, plus display and printer port.

At under $2000 for Intel's go-faster board, I suspect a lot of 'defunct' PCs may suddenly be pulled out of cupboards. It does make for a fast machine.

Guy Kewney

Making a good thing better

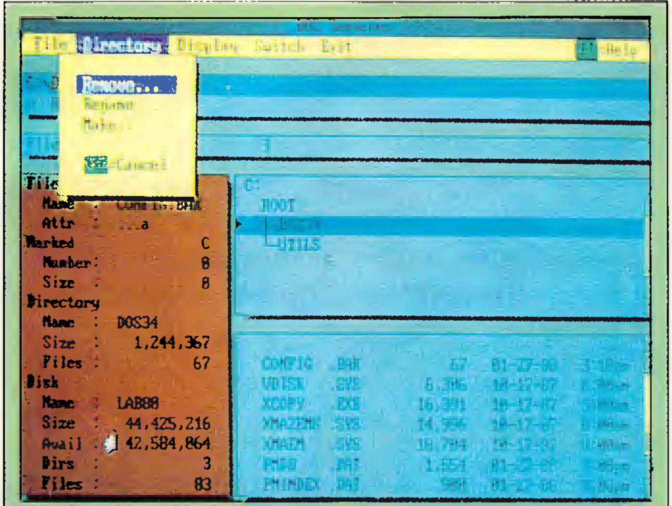
One of the best utility programs for the PC, PC Tools, has just been made even better. Central Point Software, the US publisher, has released a new version called PC Tools Deluxe. Existing features include hard-disk backup, disk optimisation, protection against accidental hard-disk formatting, rebuilding damaged data, easy disk and file management (including undeleting), and so on.

The new version also includes: a new format program which can be recovered from and UNformatted if you make a mistake; a disk cache program for increasing speed; and a flexible file editor that can be used memory-resident and which will edit *any* kind of file. On top of all this, all the old functions have been speeded up and improved.

I find PC Tools Deluxe invaluable for all sorts of filing functions. It is far easier to use and more reliable than Norton's Utilities, which is its only close competitor.

PC Tools Deluxe costs $164 and is available from PC Extras on (02) 319 2155.

Owen Linderholm



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Making good on its promise to continue supporting the large installed base of DOS users, IBM is preparing to release version 3.4 of PC-DOS, complete with a more user-friendly user command shell. The shell, known as DOS Manager, replaces the COMMAND.COM program that generates the familiar DOS prompt, and provides a windowing environment.

The DOS Manager is reportedly a character-based version of IBM's SAA user interface specification, similar to the graphics-based version that comprises the OS/2 Presentation Manager.

Meanwhile, Microsoft claims that it is still developing its generic MS-DOS version 3.4.

Toasting the winning car with . . . pasta?

Super Sprint was already the favourite multi-player arcade game in the *APC* office, when I discovered that it is also a very good way of making toasted pasta.

The original game can be seen in any arcade, but since half my readers are too respectable to go into games arcades and the other half are too young, the game is easily described. There is a race track, and you have to get around it by steering a little image of a car.

APC's arcade freak assures me that the game is better with steering wheels (as in the arcade) than with joysticks. On the other hand, at 17, he's relatively old. Eleven-year-old kids tell me that the arcade game is out of date and not nearly as good as the Electric Dreams re-creation. They also beat me.

It's addictive, and the reason it makes good toasted pasta is that you get very excited when you beat the computer car.

In each race there is a different track, with different bends, hazards, jumps and the like. Two players on an Atari ST can have a joystick each; one player can use the keyboard, and the computer plays too. If the computer car gets home before you, you're out and have to restart. But if you beat the computer, then Wow! You keep your points, and you can soup up your car.

The computer doesn't drive very fast, so you can beat it quite easily. As you would expect, the computer gets around this by cheating. For example, after the first few tracks, the computer starts introducing patches of mud, oil slicks and gusts of wind into the game.

Drive into an oil patch, and your car will go into a random spiral. At the other end, you may be pointing in *any* direction — including back into the oil. It can take several long seconds to get out.

Strangely, when the computer car hits a mud slick, it spirals through it and emerges at the other end pointing in the right direction.

Ah, well, that's artificial malevolence for you. So is the bug which occasionally turns your steering wheel into little clouds, and pushes you into the barrier to explode in flames. And so is the bug which means that if you get the highest score and then try to restart, the computer won't record your score on the all-time greats list.

What makes the game worth playing, of course, is that you don't have to play on your own; and, more to the point, you don't have to wait for someone else to finish with the computer before it's your turn.

What makes it fun are all the little details: the crowd, waving flags which are the colour of the winning car; the little animated cartoon of the driver who came last, vainly trying to repair his heap of junk; and the rescue helicopter, which cloppers overhead when you crash and puts a new car on the track.

Toasted pasta? Well, all you need is a pot filled with hot water, and enough pasta to feed whoever is going to eat. Put it on a low gas to simmer and, while it is cooking, go and have just one quick game of Super Sprint.

Miraculously, just as you are about to break the all-time high score, the smell of toasted pasta will reach your nostrils.

Guy Kewney

Chips for all

Last April there circulated a story that one of the first people to buy a new IBM PS/2 Model 50 was an employee from Chips & Technologies (C&T), the company whose chips have made PC/AT and 386 clones possible.

Supposedly, this person took the machine back to the company's Silicon Valley labs, and the hard work of analysing and reverse engineering started.

The story was true.

Now, some nine months later, C&T is ready to start producing its Micro Channel Architecture chip set. When used as part of a suitable

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motherboard, which C&T has also designed, it should be possible for manufacturers to launch their PS/2 clones.

Chips & Technologies is now three years old, and though vice president, Dado Banatao, is too bashful to admit it, the company taught IBM a thing or too about system integration.

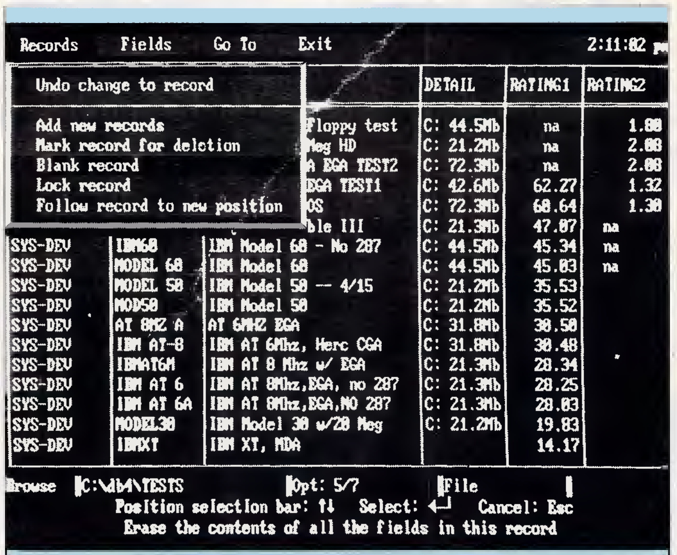
The first IBM PCs and ATs used masses of TTL chips and the like, so that the component count on the motherboard was huge. C&T made some presentations to IBM about its own methods of partitioning the AT system into a small number of discrete, integrated components. Ironically, the new PS/2 range typifies and refines this approach so that reverse engineering the machines is no trivial task.

According to Banatao, anyone could reverse engineer a PC or XT in a garage in a month, but it needs the resources of a semiconductor company to reverse engineer custom chips. From his point of view he's bound to say that, but his warning does suggest that there won't be a flood of PS/2 chip sets from other manufacturers.

At a computer show last month, Western Digital also showed its PS/2 chip set on a prototype motherboard together with the requisite new-style bus connectors.

On present showing C&T looks like delivering its chips first, but the fact that graphics card manufacturer, Paradise, is a subsidiary of Western Digital may mean that a fully-integrated Micro Channel/VGA system will come from that quarter first. Either way, the move to match IBM's PS/2 offerings is now under way.

Derek Cohen



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│ Lock record                    │EGA TEST1    C: 42.6Mb   62.27    1.32
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SYS-DEV    IBM AT 6A  IBM AT 8Mhz,EGA,NO 287   C: 21.3Mb   28.03
SYS-DEV    MODEL30    IBM Model 30 w/20 Meg    C: 21.2Mb   19.83
SYS-DEV    IBMXT      IBM XT, MDA                          14.17
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The long-awaited sequel to dBASE III Plus has been 'released' (in fact, the product will not be available until June) by Ashton-Tate in the form of dBASE IV. New features of the package include the improved Control Center interface, an SQL module, query-by-example facilities, a 'pseudo-compiler' and a link to the Chartmaster graphics package. While substantial modifications have been made to the leading PC database, dBASE IV is claimed to be compatible with dBASE III Plus source code. Ashton-Tate justifies the higher $1395 price tag by the fact that dBASE IV involved 400,000 lines of source code — versus only 100,000 lines of code for dBASE III Plus.

Joining hands to outwit IBM

Everyone is supposed to raise a cheer at the sight of Apple teaming up with DEC, the world's second largest computer builder, in an attack on the dominance of IBM.

Not so.

An observation: if Apple and DEC break the 'dominance' of IBM, they will treat the market in exactly the same way as IBM does, only more so, because IBM has, over the years, learned to live within the law which has tamed it.

Another observation: Burroughs and Univac formed a joint company last year. The result: Univac customers are on the point of shooting their new supplier, which (they say) isn't treating them like the old one did.

A prediction: if the strategic alliance between Apple and DEC achieves anything at all, it will be a situation where each company suppresses inventions that conflict with the partner's current milch cow.

I'm sure I've said this before: why do the computer builders who are not IBM believe that we want *them* to be IBM instead of IBM is not that it is *called* IBM, but that it dominates the market and thereby makes innovation difficult. *Any* dominant company is likely to be as suppressive of good ideas.

And, judging by Apple's past record, I suspect it would be a lot more suppressive of ideas than IBM has ever thought of being.

Guy Kewney

Upstart gets started

For people who like the idea of the NeXT machine which Steve Jobs (founder of Apple) is reported to be building in secret splendour in the US, here is news of something more modest which aims to do something similar.

The idea is to use a PostScript driver to run the screen of a computer.

The company is Upstart Corporation, founded by a name of equal note in the micro business, Lee Felsenstein, who originally became famous as the designer of the Osborne 1 portable CP/M micro.

His new machine, called Nomax when I saw him recently in Berkeley, is based on an Intel 80386 chip and has a high-resolution screen. The clever part is that, since the screen is generated by PostScript, a simple dump of the screen image to the printer is all you need for typesetting.

Well, it isn't quite that simple because, for a start, no screen will have the 300 dots per inch of most laser printers. But, since PostScript is resolution-independent, the same data that produces the screen will be fed to the printer, and the only difference will be that the printer is better quality.

As Felsenstein put it when pre-launch demonstrations were on in California recently: "This removes the WYSIWYG issue." What you see is *exactly* what you get.

What makes this startup Upstart company worth reporting is simple. When Felsenstein starts talking about new technology, it isn't because he has met some plausible engineer who has sold him on an idea (a dig at Steve Jobs — sorry, Steve) but because he has built a working prototype.

Backing him, Lee has several names worth the venture capital in their own right. Arvind Patel, who founded Paradise Systems, among five others — he is chairman. John Simpson, VP of marketing, was founder of Reflex originator Analytica Corporation after his time with DEC and Burroughs. Charles Woodford, product development VP, was founder of Selfware and author of WordFinder, the leading thesaurus product.

Felsenstein (here, let me quote from his press release): "Felsenstein contends that Nomax will attract a large number of PC users who are reluctant to buy a Macintosh, but who want the benefit of Mac-like features

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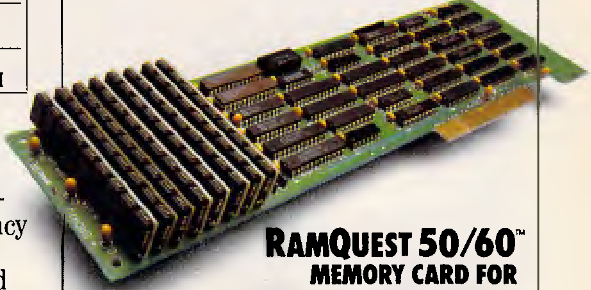

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and performance in their desktop publishing systems."

With the Nomax box, Upstart will give away Windows/386 as an operating environment, making the beast perfectly capable of running any standard DOS program.

Anyone interested should contact Simpson in California on (415) 652 5393. Upstart is at 2200 Powell Street, Suite 880, Emeryville, California 94608.

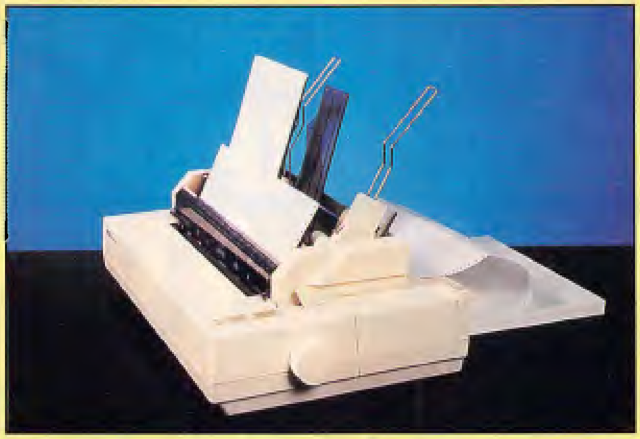
Joint Apple/DEC announcement at Macworld

This year's Macworld (San Francisco, January) was overshadowed by the announcement that Apple and Digital Equipment would enter into a joint technology agreement, thus allowing the two companies and their technologies to be part of a powerful global computing solution.

This announcement came hot on the heels of a similar agreement between AT&T and Sun Microsystems, as AT&T has agreed to purchase 20 per cent of Sun's stock. We now have quite a battle shaping up between Apple/DEC, Sun/AT&T and IBM for the dominant position in the PC/workstation market.

The important part of the Sun/AT&T alliance will be that Sun will have access to the merged Unix 4.2 and 5.0 as much as 18 months before the competition. But, Apple's own A/UX (Unix) system will be out soon, and when the Apple/DEC technology links into DEC's OSI, Apple and DEC will become a powerhouse to be reckoned with.

As for the show itself, it had few surprises. The most interesting rumour on the floor was that Ashton-Tate had bought the long-awaited FullWrite package from Ann Arbor Software. This was confirmed by two Ashton-Tate sources who asked not to be identified; and, according to these sources, Ashton-Tate will finish some housekeeping on the project and release it under its own label by mid-year. A pre-release copy will be shipped to those who have already bought the product, but it is not in any way the finished version.



The Epson LQ-1050 printer will be launched at Sydney's PC '88 this month.

The most exciting game at the show was Silicon Beach's Apache Strike Force. This drew a rave response from the crowd, and those who have played it say it is the most addictive action game they have ever seen.

Claris, Apple's software spin-off, showed one product that really drew a lot of attention. Besides upgrades of MacPaint, MacDraw, MacWrite and MacProject, the company's new forms package, SmartForms, showed the true flexibility of a dedicated forms design tool and its interactive nature.

Many companies like E/Machines and SuperMac showed their new colour screens, but RasterOp showed the only 24-bit colour screen and dazzled attendees with its incredible visual effects.

Although there have been great breakthroughs in colour displays, colour output is still far behind. The one machine that did show promise came from Maris Technology. This company is backed by Apple's Venture Capital fund and makes a high-resolution slide-making device. The unit is half the size of Presentation Technologies' Imagemaker, and can produce slides of up to 8000-line resolution. Sydney-based company, InfoMagic, is considering taking up Australian distribution of the product.

Another item that attracted a lot of interest came from Orchid Technologies. Its ColorView/SE card fits into the one open slot in the SE, and allows the user to then plug on a separate colour monitor, and IBM VGA monitor. The price of the board will be around $US695. Contact Porchester Computers on (03) 537 2722 for more details.

And finally, an exciting product came from Radius Inc, the company that produced the first large-screen display for the Mac. Its 25MHz SE accelerator card, with a Motorola 68881 co-processor, makes the SE run as much as 10 times faster than it presently does, with just a 68000 chip. It should be available from InfoMagic in next month or May.

Tim Bajarin

New laptops expected from IBM

IBM is reported to be developing 80286 and 80386-based laptops capable of running the OS/2 operating system. The company has admitted to plans for releasing six or seven new PS/2 models this year, and a similar number during 1989.

PC showtime

The annual PC exhibition held in Sydney each March is always the first major Australian computer show to be staged after the monumental Comdex/Fall in Las Vegas (held in November). For this reason, it usually represents the Australian launching pad for many of the key PC products released each year.

However, the Sydney PC exhibition has been plagued in the past by the lack of a suitable venue. The cluttered and claustrophobic confines of Centrepoint are notoriously inappropriate, and are rumoured to have caused more than one frustrated attendee to contemplate taking the lift up to Sydney Tower and leaping off.

But this year, according to Australian Exhibition Services (AES), the PC '88 organisers, things will be different. For the first time the PC show will be held at the expansive Darling Harbour Convention Centre.

As last year's Comdex/Fall was one of the biggest and best ever held, PC '88 in Sydney, scheduled for March 20-23, looks set to become a record-breaking show. As one of the very first exhibitions to be held at Darling Harbour, PC '88 should a attract a fairly sizeable, crowd simply by virtue of its novelty value.

Being a show for the general public, the doors are scheduled to open on a Sunday, which should ensure a huge crowd on the first day. However, the proportion of genuine buyers versus 'tyre-kickers' is sure to become a hotly-debated issue (as always) during post-show post mortems.

There will actually be three exhibitions in one at Darling Harbour, as the PC '88 show will be held concurrently with Communications 88 and Office Technology 88, ensuring that the new venue is filled to capacity. All available exhibi-

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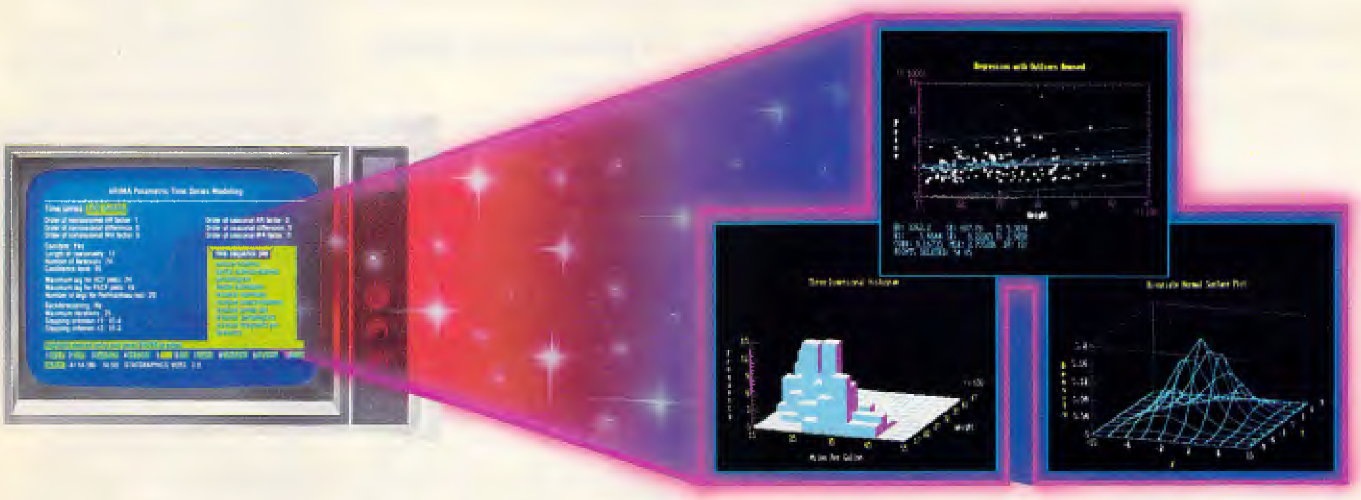

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tion spaces have been booked out, according to AES, despite a last-minute amendment to the exhibition dates.

All of the big names will be there, according to the organisers (there is no point reciting the list, since most can be found as advertisers within this issue of *APC*). IBM PC users will find OS/2 running at several stands, and possibly even some OS/2 applications as well — but don't expect anything too fancy. Macintosh users will also be catered for — particularly those who are up-market enough to own a Mac II. And of course, there will be an abundance of new products on display for users of Commodore, Atari, and other brands. Just about everything you read about that was demonstrated at Comdex/Fall should be found somewhere at PC '88.

Like television programs and movies, we always tend to see things here a few months later than our US counterparts. Still, it is convenient in the long term, as the US user base acts like one big quality control centre, sorting out the dud products from the stars before they have a chance to reach Australia.

New hardware will also feature at PC '88, with continually improving PC and AT clones arriving from Taiwan. As always, the number of Southeast Asian exhibitors has increased again for PC '88. While most major Taiwanese manufacturers are developing PS/2 clones, don't expect to see many of these at PC '88 in Sydney. At the forthcoming PC '88 in Melbourne (June 1-4), however, there will be hoards of cheap Taiwanese Model 30 clones. True Micro Channel-based clones should be here in time for the Australian Computer Exhibition in Sydney during September.

Among the new software on display at PC '88 will be the Page Perfect desktop publishing package, version 3 of GEM from Digital Research, WordPerfect 5.0, Space Edit and Simul for the Macintosh, a two-dimensional CAD package for the Mac II called Jonathon (very original!).

New internal and external modems from Avtek will be on show at PC '88.

Some of the hardware offerings expected are a range of new modems from NetComm, along with an associated rearrangement of prices on existing models. In other words, think carefully about buying anything until after PC '88 has been held.

One of the few non-commercial organisations manning a display at PC '88 will be the Melbourne PC Users Group. Currently the largest organisation of IBM PC and compatible users in Australia, the Melbourne group is actively seeking out more interstate members. The user group will be demonstrating, among other things, its 80386-based bulletin board service, which is one of the most active in the country.

So if the finances are a bit tight, and all of the expensive new hardware and software is beyond your budget, at least you can commiserate with some fellow PC users and pick up the latest in public domain software.

Watch these pages next month for a full PC '88 debrief.

Taiwanese delay clones

The promised debut of the first Taiwanese PS/2 clones was postponed at the last minute, due to "Micro Channel legal problems," according to the organisers of a recent Taipei exhibition. While clones of the Model 30 were exhibited, these represent no great challenge as they are not much more than PC XT variants. However, it is clones of the Micro Channel-based Model 50, 60 and 80 which are eagerly awaited by the PC industry, and which have so far failed to materialise.

Towards the NeXT generation PC graphics

Over the past two years, the personal computer has become a very powerful machine.

Fifteen years ago, a computer the size of a 10ft x 15ft room would have been needed to give the same computing power as today's desktop 80386 PC. One of the economic principles that drives the industry is that 'the more computer literate the user, the more power they will demand.'

This alone should give you a hint of what future PCs will be like, and 1988 is the year the personal computer will be transformed. Soon, Steve Jobs, founder of Apple Computer and now president of NeXT Inc, will unveil his new personal computer.

This machine, originally thought to be just a high-powered workstation for the education market, is actually a computer that could push PC technology to its limits and define the design of the next generation. And sources close to Jobs say that it will be available for the business community as well.

Steve Jobs has already given the world two computing standards in the Apple II and Mac lines. His associates confirm that he really believes he is a technological messiah who will bring the world the next generation of PCs.

According to sources close to NeXT, Jobs' new machine will bring high-power graphics workstation capabilities to a personal computer costing less than $20,000. This machine will bring the personal computer and graphics workstation even closer.

Much of this technology has come from Jobs' 1987 acquisition, Pixar. This company sells high-end graphics workstations and was founded by George Lucas, director of *Star Wars*. It produced much of the computer-aided graphics in his films.

At the same time, traditional high-end workstation companies like Sun Microsystems and Apollo are bringing their prices down and adding more graphics capabilities to these low-end workstations: PCs and workstations are quickly becoming one. In fact, Sun will very soon introduce an 80386-based system that has its SPARC RISC chips integrated into a standard PC configuration.

Take a good look at the serious graphics workstation. This will be the PC of 1990.

Tim Bajarin

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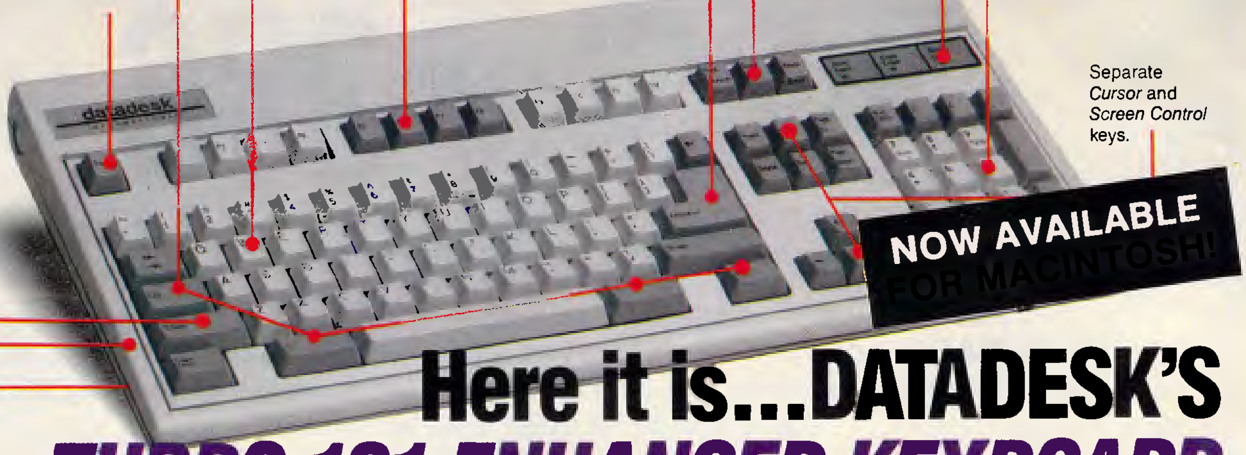
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NeoStar 386

Last year, KCM released an AT compatible machine which ranked among the best APC had ever seen, and at one of the lowest prices. This year, KCM has taken on the NeoStar 386, and Ian Davies takes a look to see if KCM has managed to hit upon another winner.

Many industry observers argue that there is little need for high performance machines. They maintain that most computers are used for word processing and accounting, and that the machine is almost always waiting on the user, not the other way around. They persist in the view that only the rarefied upper echelon of users — software developers and Lotus users modelling national economies — actually have a valid claim on high performance requirements.

Yet we all know this to be patently irrelevant. True, any given machine may be 90 per cent keyboard-bound, but the 10 per cent of the time in which the user waits for the machine will be a constant source of frustration. Virtually any 'simple' application can demand a high performance processor, not to mention file servers on any reasonably-sized LAN.

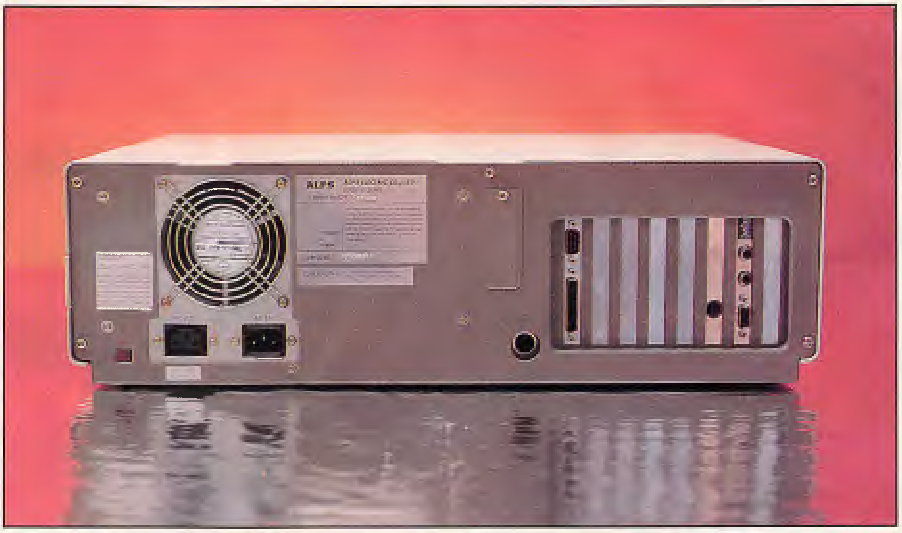
However, the main reason 80386 processors are coming off the 'top shelf' and being applied to normal users is architectural. The 8088/8086 processors are limited to one megabyte and the 80286 cannot adequately support multitasking. The 80386 is the only chip in the range which can do all these things, plus more, and offers an architecture which will last the next decade.

There are few people who would dispute these points, and even fewer who would turn down an 80386 in favour of an 80286-based system. The deciding factor, as always, is price. Depending on the make, it is relatively straightforward to spend $20,000 on a modestly configured 80386 system — an amount which virtually precludes usage as a single-user workstation.

It's difficult to understand why 80386-based systems cost so much. Most of the gear inside the computer is very similar to an 80286 system. Sure, the chip is more expensive and the motherboard needs 32 wires running about the place instead of 16, but that hardly justifies the price many major manufacturers are demanding.

Fortunately, a number of things are happening to correct this situation. One is the forthcoming Intel 80486 — a repackaged 80386 aimed to reduce the cost of building computers. Another is the availability of 'chip sets' from people like Chips & Technologies which serve to reduce component counts and simplify motherboards. A third factor is a small number of manufacturers building good quality computers at a reasonable cost.

KCM has managed to latch on to one of these rare birds. The NeoStar 386, manufactured by Mitsui in Japan, is available as a complete system, including 45Mbyte hard disk and monitor, for around $7500. Most vendors charge upwards of $14,000 for a similar configuration.


The rear of the NeoStar 386 reveals five free slots and VGA card outputs

Outside

Physically, the NeoStar resembles a normal AT-sized box in the usual cream colour scheme. The case is secured by five screws on the rear, and slides forwards to reveal the internals. This is in contrast to the growing trend of 'flip-top' PCs, where buttons on the side let the cover swing back in one effortless motion. If you are the sort of user who continually whips the top off his machine to fiddle with the expansion boards, then the flip-top arrangement will be preferable. If, on the other hand, you need to discourage wandering bands of board bandits, then the conventional screw-down system used on the NeoStar would be most appropriate.

The power switch is of the large red toggle variety, and is positioned in the customary location on the side of the case and towards the rear. The power supply module has an integral fan designed — like so many other computers — to draw dirty air through the disk drive slots, filter the dust carefully over all the components, and expel clean air out the rear. It is perplexing why this approach seems to be the convention, but almost everybody does it. (One occasionally comes across a machine with dust filters on the air intake, but they tend to be the exception rather than the rule.) The point may seem trivial, but it is instructive to open any PC which has been in a working environment for a couple of years and see just how much dust and assorted crud has been plastered over everything.

The rear of the unit also presents the power connectors, including a power feed for the monitor, thereby allowing the monitor to be switched off automatically when the system unit is powered down. The keyboard connector is also on the rear — a position which still defies rational explanation, but is the accepted norm.

The front panel features an AT-style indicator bank, with LEDs for power and hard-disk access. A key lock mechanism deactivates the keyboard, but like most machines, does not prevent the case being removed and the system being 'hot-wired'. Space for two half height devices is provided, and cut-aways in the lower array of ventilator slots allow another two devices to be installed.

Unlike many machines, no reset button is provided on the NeoStar. The conventional Control-Alt-Delete sequence performs a warm boot, but the only way to achieve a cold boot is to switch the machine off and then on again. Whether this is an advantage or a disadvantage again depends on your application. For LAN file servers, a reset button is not such a good idea as it is all too easy to knock or lean against it with disastrous results. For a development machine where crashes and lock-ups happen all the time, a reset button can actually prolong the life of your machine by reducing the frequency of power ups.

Inside

Removing the top reveals a ruggedly constructed chassis dominated by the hefty power supply unit. A piezo-electric speaker mounted behind the key lock panel provides for audio feedback, and a Sanyo 3.6-volt battery is mounted in a

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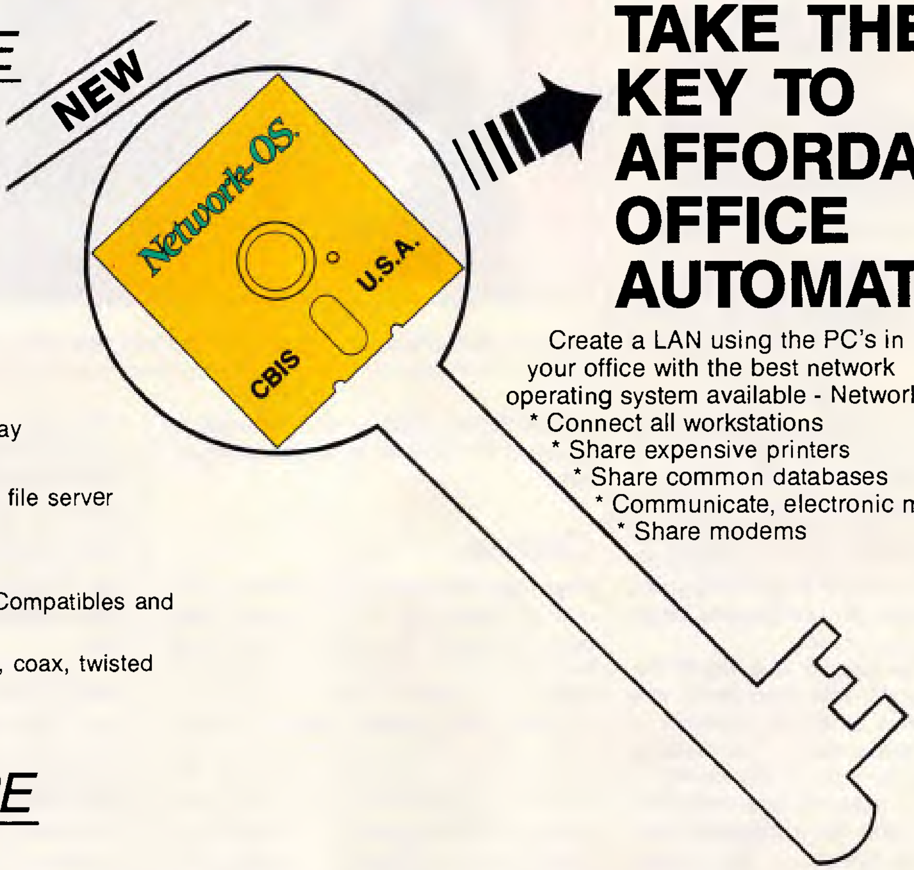

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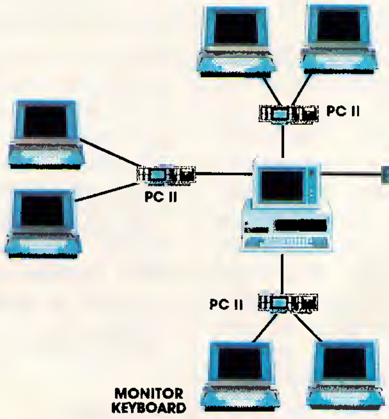

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virtually inaccessible position underneath it. The battery is responsible for maintaining the real time clock and the CMOS RAM configuration details.

The motherboard, or 'planar' board in the new nomenclature, is relatively sparse. Its most prominent feature is the large 80386 chip, rated to 16MHz. Half a dozen PALs and a smattering of SMT (surface mounted) chips provide most of the functionality. The rest of the motherboard is primarily 7400 series MSI chips.

The review machine also contained an 80387 numeric coprocessor, an option which would normally cost around $1300 extra. The ROM BIOS is implemented in a single chip, and is courtesy of ALPS. The ROM switches the processor down to low speed when the floppy disk is in use. This trick often avoids problems with copy-protection mechanisms when running on very fast machines. It is quite interesting to watch the BIOS at work by running benchmark programs from the hard disk. Norton SI, for example, claims a rating of 10.3 while the floppy is still spinning. When the motor stops, the SI jumps up to 18.7. At full speed, the NeoStar performs equivalently to an AT running at 17MHz, or 11 times as fast as the original XT.

Unusual these days, a number of switches and jumpers are present on the board. These are all clearly marked and easily accessible once the cover is off. One switch toggles between 512k and 640k conventional-memory configurations, while a jumper selects between monochrome and colour-primary display modes.

No memory is provided on the motherboard. Instead, a full 2Mbytes is situated on an expansion board which plugs into the first expansion slot. This board features an array of 72 256k bit memory chips, supplemented by the usual 7400 series chips. The memory performs at an impressive 80ns — far faster than most of the chips in use today. It is this speed which allows the processor to operate without any wait states.

At one end, the board plugs into the normal AT expansion slots. At the other, a special 96-pin connector mates with a receptacle on the motherboard to provide access to memory 32 bits at a time, as well as additional address lines. Spare mounting positions on the board allow a 16450 communications controller chip to be added to provide an additional serial port, although this is not an upgrade most users would contemplate performing themselves. Memory can be expanded up to 16Mbytes.

Only one 32-bit expansion socket is provided on the motherboard, which implies that only one 32-bit board can be installed. Most manufacturers circumvent this limitation by providing a piggyback connector on the primary memory expansion board. The NeoStar currently does not have such a connector. This is a failing of the memory board and not the motherboard. KCM advises that new memory boards should be available by April which include the connector.

Until such time, memory expansion must be performed by plugging in normal AT-style 16-bit memory boards. This is both good news and bad news. The bad news is that the 16-bit memory will perform more slowly than full 32-bit memory, and the good news is that because of this, only 120ns memory chips need be used. This comes about because the conventional expansion bus runs at a lower speed than the 32-bit bus.

Eight expansion ports are provided on the motherboard, two of eight bits, one of 32 bits and five of 16 bits. The 32-bit port is occupied by the memory expansion, one of the 16-bit ports goes on the controller card, and one of the 8-bit ports is usually consumed by the display adaptor. This leaves four 16-bit and one 8-bit port remaining for future expansion.

I/O

A full-length card occupying one of the 16-bit slots provides most of the I/O and interface capabilities. A large Western Digital chip is able to control two floppies and one hard-disk drive.

The mounting bracket on the board provides access to the printer and serial ports which are implemented on the I/O card rather than the motherboard. The communications port is of the 9-pin 'D-type' popularised by IBM with the AT. Of course, now IBM has reverted back to 25-pin sockets on its PS/2 machines, leaving behind a dual standard for RS-232C connectors and a healthy industry building 9-pin to 25-pin adaptor cables. The printer and serial ports can be configured via jumpers as COM1, COM2, LPT1 or LPT2.

The RS-232C port is controlled by an Intel 16450, a newer version of the old 8250 used in most 8088 and 8086-based machines. Recently, the industry has noticed that IBM's version of OS/2 does not function correctly in all modes when used with the older chips — all part of IBMs gradual divergence initiated with the PS/2. The fact that the NeoStar uses a 16450 chip is one less point to worry about in future compatibility.

The standard price of the NeoStar includes either a Hercules or EGA compatible display adaptor but no monitor. The machine provided for review contained an EGA compatible from a company called Genoa Systems. This is a half-length card based on a chip set from Genoa and manufactured in Japan. The usual EGA expansion port for piggyback memory is included.

KCM reasons that a monitor should not be included as standard since user requirements vary so much and the price of an appropriate monitor can range from $300 up to $2000. This makes good sense.

The machine supplied for review included an NEC Multisynch monitor — a lovely device capable of consuming both TTL and analog video signals.

The floppy-disk drive is a 1.2Mbyte Toshiba, with plenty of room underneath for a second half-height device. KCM

In perspective

The world can always do with a quality machine at an affordable price, and these are all too rare in the 80386 market. There are a number vendors offering good machines at exorbitant prices, and some vendors with fairly dodgy, over-priced machines.

The only issue which would prevent masses of people from rushing out with their cheque books is good old Big Blue and its Micro Channel bus. For IBM has achieved its objective with the PS/2 range, and brought a great many users back to the fold.

In many ways, the 80386 is the processor of choice for the 1990s. Its benefits are simply too great for the industry to continue wasting time with the stop-gap 80286. However, aligned with the 80386 is the Micro Channel, an architecture which can take advantage of a decent processor with good addressability like the PC architecture could never hope to. The MCA is clearly a path to the future.

Based on this, one can easily conclude that the machine for the next decade will be an 80386 with a Micro Channel bus. At the present time, there is only one vendor who sells such a machine, and that is IBM, at twice the price.

However, for all those who have immediate requirements *today*, the NeoStar will certainly find a place as being one of the cheapest and best quality machines available in the top performance bracket.

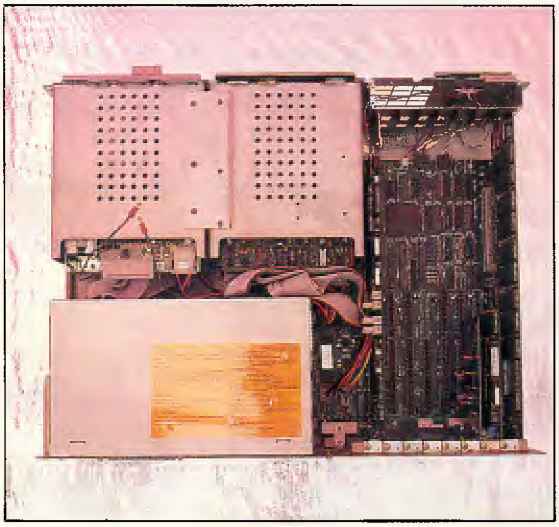
Benchmarks

IntMath	0.3
RealMath	1.4
TriLog	6.8
TextScrn	24.8
GrafScrn	3.2
Store	1.5
Average Disk Access	41.8 ms

Specifications

Processor:	80386 at 16MHz with no wait states
RAM:	2Mbytes of 80ns
Display:	Hercules or EGA compatible
Ports:	Serial and Parallel
Expansion:	one 32-bit, two 8-bit, five 16-bit
DOS:	Microsoft 3.3 and GW-Basic
Floppy:	1.2Mbyte
Hard Disk:	Optional
Price:	$6100

also does not provide a hard disk as standard. The user may choose between 20Mbyte models all the way up to 75Mbytes. The hard disks are always Miniscribe voice coils, with KCM particularly recommending the 45Mbyte Miniscribe with an average access time of 25ms. The review machine contained a 30Mbyte Seagate, also a voice coil but with less spectacular performance figures than the Miniscribe. In configuring a system, it would certainly be hard to go past the Miniscribe — KCM charges only an extra $1590 for the 45Mbyte voice coil.


The 80386 processor is clearly visible

Storage devices are mounted in the machine in an unusual way. Normally, the device just slides into position and is secured by screws on each side. In the NeoStar, however, a pair of plastic 'rails' must be screwed onto the device which can then be slid into position. The device is secured by a series of metal brackets which prevent it from sliding out again. No matter how hard you try, it is just not possible to install a new device without first getting a pair of these rails from KCM.

The keyboard is one of these newfangled 102-key affairs, with separate numeric and cursor pads and twelve function keys — the same as used on the PS/2 machines. This is a good layout, except for those people who have become very accustomed to the original PC layout. Nevertheless, this layout seems to be here to stay, and IBM is even running the function keys across the top of the keyboard in all its new mainframe terminals.

Underneath, small channels lets the cable to be routed either to the left or the right, and the usual pop-up legs allow for ergonomic placement. Internally, the keyboard is based on a central PCB with a metal chassis, and is quite straightforward to open without all the keys falling in your lap. The key mechanisms are individually soldered into the PCB, making them far more difficult to replace. However, superior sealing makes replacement far less likely than in, for example, an M24 keyboard.

The keyboard housing is also very rugged, being clipped together by four sturdy clips and then secured with six screws. This is one keyboard that could take quite a few drops.

All the components inside the machine have been manufactured in Japan, excluding a couple of foreign chips such as the disk controller and CPU.

The machine comes complete with GW-Basic and MS-DOS version 3.3. These are the original Microsoft versions, and not OEMed by Mitsui. As such, the documentation and packaging is up to the normal Microsoft standard.

Prices

This is the best part. The basic NeoStar, featuring 2Mbytes of memory, a 16MHz no wait state processor, display card, keyboard, MS-DOS, GW-BASIC, serial port, parallel port, real time clock and a box of ten high-density diskettes costs just $6100. What you get is a fully functioning system minus the monitor and a hard disk.

The amazing thing, however, is that upgrading your configuration to a truly *practical* system doesn't cost an arm and a leg. For example, adding a 45Mbytes voice coil hard disk and TTL monochrome monitor takes the price to just $7690. For this you get a quite respectable system which would be well equipped as a file server or development system.

The price also includes twelve months of full parts and labour warranty followed by another twelve months covering labour only.

A numeric coprocessor costs around $1300.

Conclusion

In some ways, the NeoStar is a rather dull machine. In other ways, it is vitally interesting.

The performance is great, but no better than most 80386-based machines. The quality is good, and the construction is robust. It comes from a reputable company and is well designed.

In short, there are no penetrating criticisms we can make of it. Likewise, it doesn't break into any new technological frontiers.

It may sound a little wishy-washy in that respect. But viewed from another angle, the NeoStar is a good, solid machine at a reasonable price. And that is always interesting.

The same was true of the A*Star, KCM's AT class machine, and it is fascinating that KCM has managed to find another winner in the 80386 stakes.

Perhaps the best way to summarise the NeoStar is to say that it is one of the very few machines that I could actually see myself buying.

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PC NETWORK

Inboard 386/PC vs Quad 386XT

These two boards effectively turn tired old 8088-based PCs into turbo-charged 80386 speed machines — and for less than you might expect.

The 80386 remains unchallenged as the best DOS processor on the market, making PCs equipped with lesser chips seem as up-to-date as pet rocks. Although installing a turbo board can keep your PC more timely, until now 80386-equipped products have required an AT to build upon. This twosome — the $1995 Inboard 386/PC, from Intel, and the $2295 Quad386XT, from Quadram — finally bring that 32-bit power to 8088-based computers.

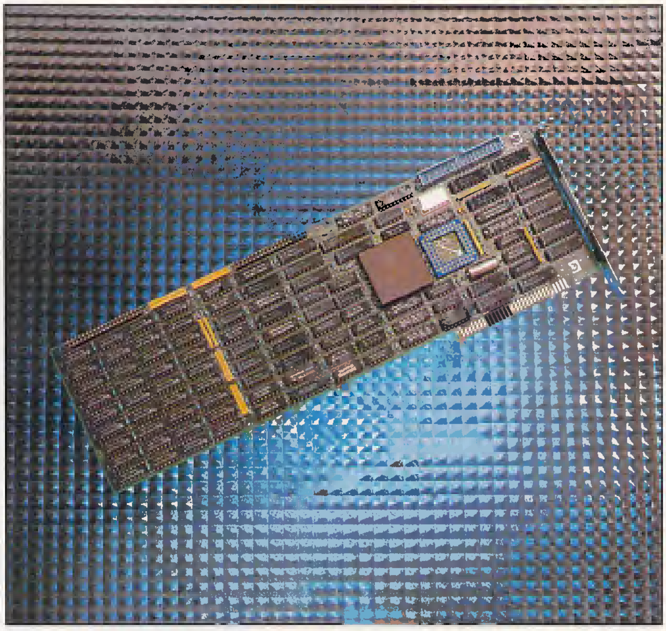
The two boards are similar in both concept and design. Both are replacement-style turbo boards. You pull out the 8088 microprocessor in your PC or XT and pop a special adaptor cable into its vacant socket. The cable lets the board take over for the 8088, while the card also connects through the standard PC bus in a single full-length expansion slot for power and other logic connections.

Both boards are designed for IBM PCs and XTs with specific support for certain clones. They will not work with 8086-based compatibles like the Olivetti M24 and Compaq Deskpro (the Compaq Portable and Portable Plus are fine).

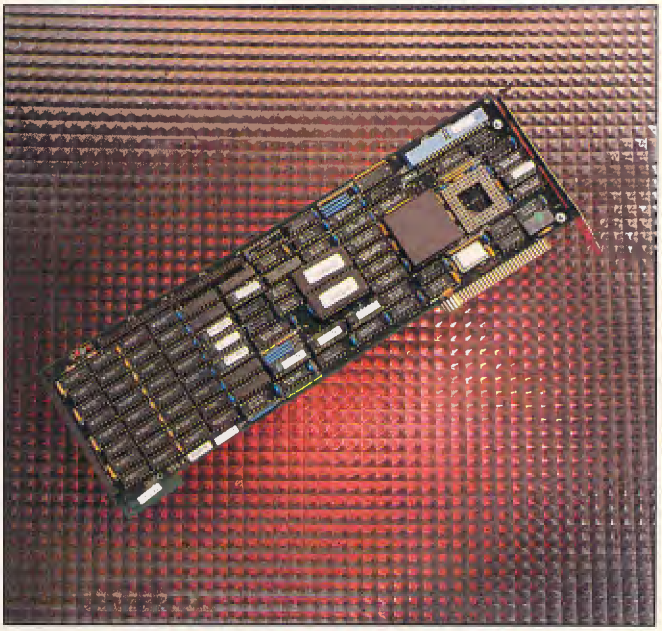
Although both manufacturers recommend boosting the power supply of your PC to more than 125 watts, in testing, a standard PC ran each product as well as an admittedly low-power hard disk card (a 5 to 8-watt Western Digital FileCard 10). If you don't have one, you'll want to add some kind of hard disk to take advantage of turbo performance.

Superficially, the boards look very much the same. Both have the square black 80386 chip almost midway on the card with a vacant coprocessor socket nearby. The vital connecting cable attaches at the top, and 1Mbyte of 32-bit bus memory adorns the far end.

Both boards come standard with three



Intel's Inboard 386/PC includes software enhancements to boost other PC components



The Quad 386XT board supports a wide variety of numeric coprocessors

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dozen 120-nanosecond, 256-kilobit dynamic RAM chips. Connectors allow further memory expansion via daughter-cards — 2Mbyte more for the Intel, up to 8 more megabytes for the Quadram.

Many design details are different, however. While the Intel coprocessor socket permits only the 80387, the Quadram also hosts the slower 80287 or the Weitek 1167 for faster number crunching. The Intel cable is shorter, but its connectors are oriented more favourably than those of the Quadram.

At a glance

Inboard 386/PC
Supplier: Tech Pacific
Tel: (03) 690 9055
Price: $1995 (with 1Mbyte RAM); 1Mbyte memory upgrade approximately $1345
Requires: IBM PC or XT, Compaq Portable or Portable Plus
In short: A replacement-style 80386-based turbo board that enhances ordinary PCs and XTs with 32-bit performance. Includes 1Mbyte standard, up to 8 more megabyte of fast RAM, and support for 80287, 80387, and Weitek 1167 numeric coprocessors.

The boards also adapt differently to the memory already in your system. The Intel demands that all expansion beyond 256k be pulled out while the host's DIP switches are set for 640k. It maps its own memory over the full 640k DOS memory area, reserves 128k for phantom ROM, and delivers 256k of extended memory from its standard megabyte.

Quadram requires that you install as much normal 8-bit memory as you want the Quad386XT to replace with 32-bit, so if you want 640k of fast RAM, you've got to have the same amount of standard RAM available. Try to fool it by altering the host system's DIP switches, and the system crashes with no explanation for the error.

All but 128k of this memory appears as extended, although an amount equal to the 8-bit RAM your system has installed works as conventional memory. Quadram allows the mapping of BIOS routines into 32-bit RAM and also supplies a driver to speed up video routines and implement EMS.

Benchmark Test: Quadram Quad386XT and Intel Inboard/386PC vs Compaq Deskpro 386

We compared these two 386 upgrades for PCs to Compaq's 80386-based Deskpro 386, since it runs a 16MHz 386 processor. The two boards don't beat the Compaq, but they turn in respectable performances compared with that of the $12,000-plus computer.

Performance Times
(Times given in seconds)

	NOP	80386 Instruction Mix	Conventional Memory
Quadram Quad386XT	2.14	4.56	0.85
Intel Inboard 386/PC	1.70	4.73	0.80
Compaq Deskpro 386	1.70	4.01	0.77

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimising differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ('No Operation') machine code instructions in a big 128k loop.

The 80386 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program used 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The Conventional Memory benchmark test allocates 256k of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result is the average of

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- DRAM – 2 MB to 8 MB
- SPECIAL ON-BOARD FEATURES I/O ports– one serial port and one parallel port; five expansion slots – three 16-bit and two 8-bit

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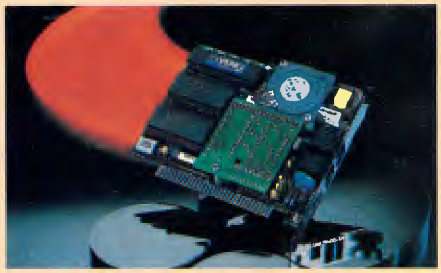

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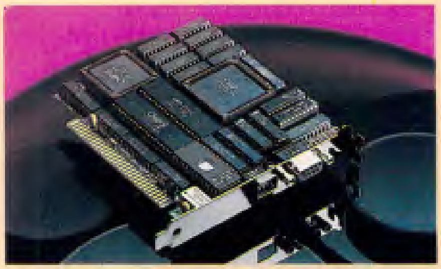

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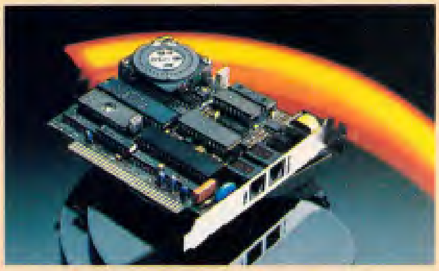

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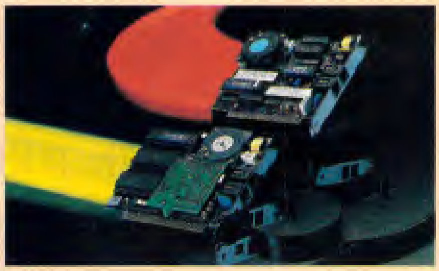

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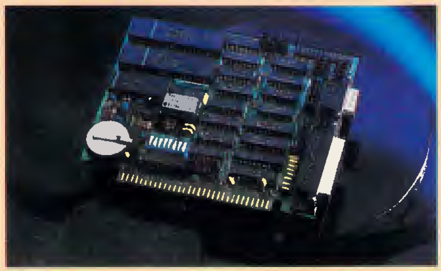

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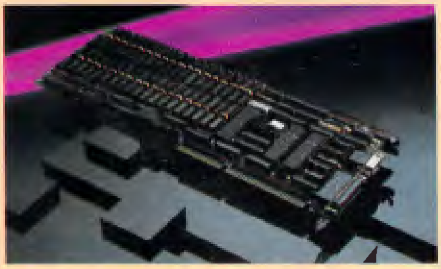

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- Half-height, 40MB formatted capacity
- 40 msec average access time
- ST 412 interface
- 20,000-hour MTBF

Everdrive 72/80MB External

- 72/80MB formatted capacity
- 30 msec average access time
- 20,000-hour MTBF
- 25-5 Watts power consumption

Everdrive 20MB External

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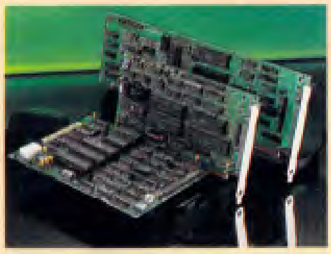

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- 32 bit ECC
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EV-1800 AT Mother Board

- 10MHz zero wait state 80286 CPU
- 512K RAM, expandable to 1MB
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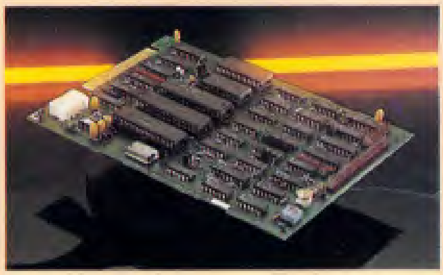

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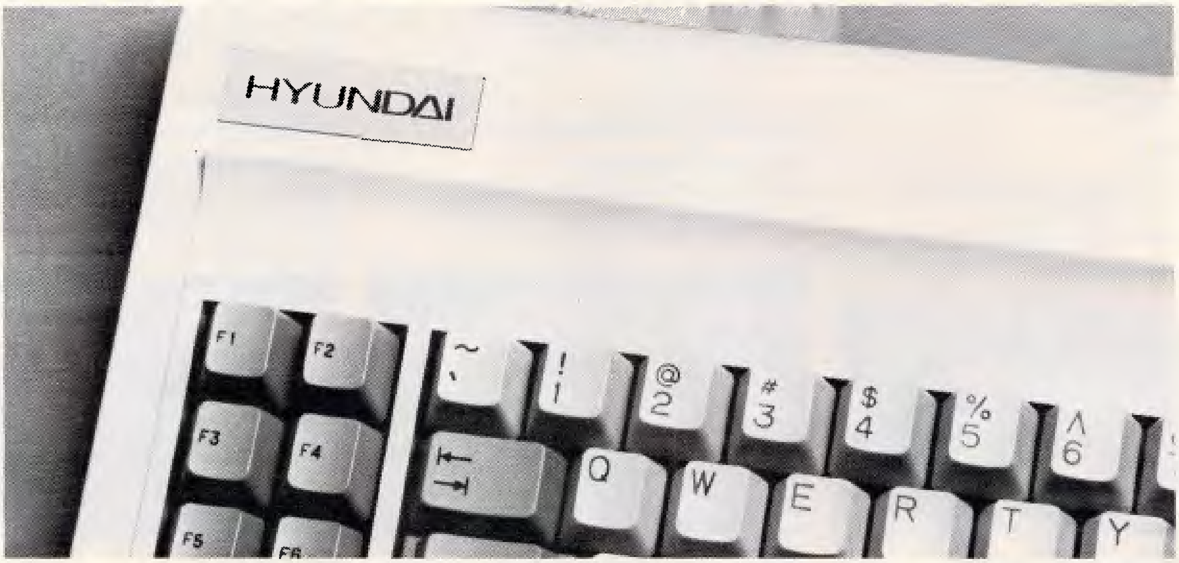
Has IBM made another Big Blue?



IBM may have made a very big blue by abandoning the PC standard it set back in 1981.

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DP

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Besides diagnostics and speed-changing software, Intel supplies an EMS driver and a disk-caching program. In addition to its drivers, Quadram also includes a performance test, diagnostics, a RAMdisk, and a print spooler with the Quad386XT.

As with most replacement-style turbo boards, both members of this twosome are well-behaved. Video updates are snappy rather than jerky, and disk access suffers not at all.

In fact, Intel's BIOS enhancements and disk cache help the rest of your aging PC system keep up with the zippy new microprocessor. Quadram's treatment of these matters is not quite as successful.

While the performance of the two products falls in the same ballpark, the Quadram earns a slight edge on CPU speed. Intel's board handles memory and system integration better.

At a glance

Quad386XT
Supplier: Sourceware
Tel: (02) 411 5711
Price: $2295 (with 1Mbyte RAM); 8Mbyte memory upgrade $1570
Requires: A range of 8088-based PC-compatibles. Check with Sourceware as to whether your PC is compatible
In Short: A replacement-style 80386-based turbo board for many 8088-based computers.

Burdened by memory wait states, the performances of both rate below that of a 16MHz Compaq Deskpro but about 70 per cent better than that of an 8MHz AT.

Of course, performance is not the only reason — or even the best one — to buy one of these products. The features an 80386 brings to your system, such as its superior memory handling and inherent multi-tasking abilities, are the biggest blessing. (Intel is bundling 386-to-the-Max, a utility that lets you run memory-resident programs out of RAM above 640k, with the Inboard 386/PC).

Both of these turbo boards deliver. Choose the Quadram board for its massive memory abilities and choice of numeric coprocessors. The Intel wins for its superior integration, cheaper price and greater on-screen snap — overall, a more satisfying and affordable product.

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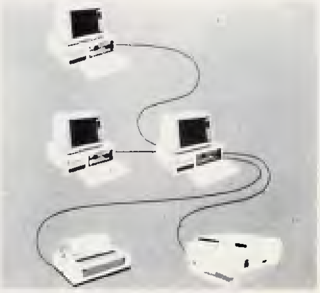

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Waiting for a miracle

IBM's much-heralded OS/2 brings with it a sophisticated multi-tasking system and many enhancements — for the professional, it's certainly an improvement on PC-DOS. But beware of the wolf in sheep's clothing. Dick Pountain tackled it head-on.

As I begin this review of IBM's new operating system, I can't help being reminded of Samuel Beckett's play, *Waiting for Godot*. The temptation to draw a parallel between the dramatic plight of the play's main characters, Estragon and Vladimir, and that of IBM's PC customers is almost irresistible, but fortunately I have resisted it; I won't even point out the fact that Estragon and Vladimir are usually depicted in Charlie Chaplin-style tramp costumes.

IBM has sown more than its usual crop of fear, uncertainty and doubt with the introduction of OS/2. Ostensibly we are offered a new operating system standard, perhaps to last us for the next decade, which remedies many of the deficiencies of PC-DOS. OS/2 is truly multi-tasking, allowing us to perform several jobs at once, and it can address up to 16Mbytes of memory instead of the claustrophobic 640k of PC-DOS.

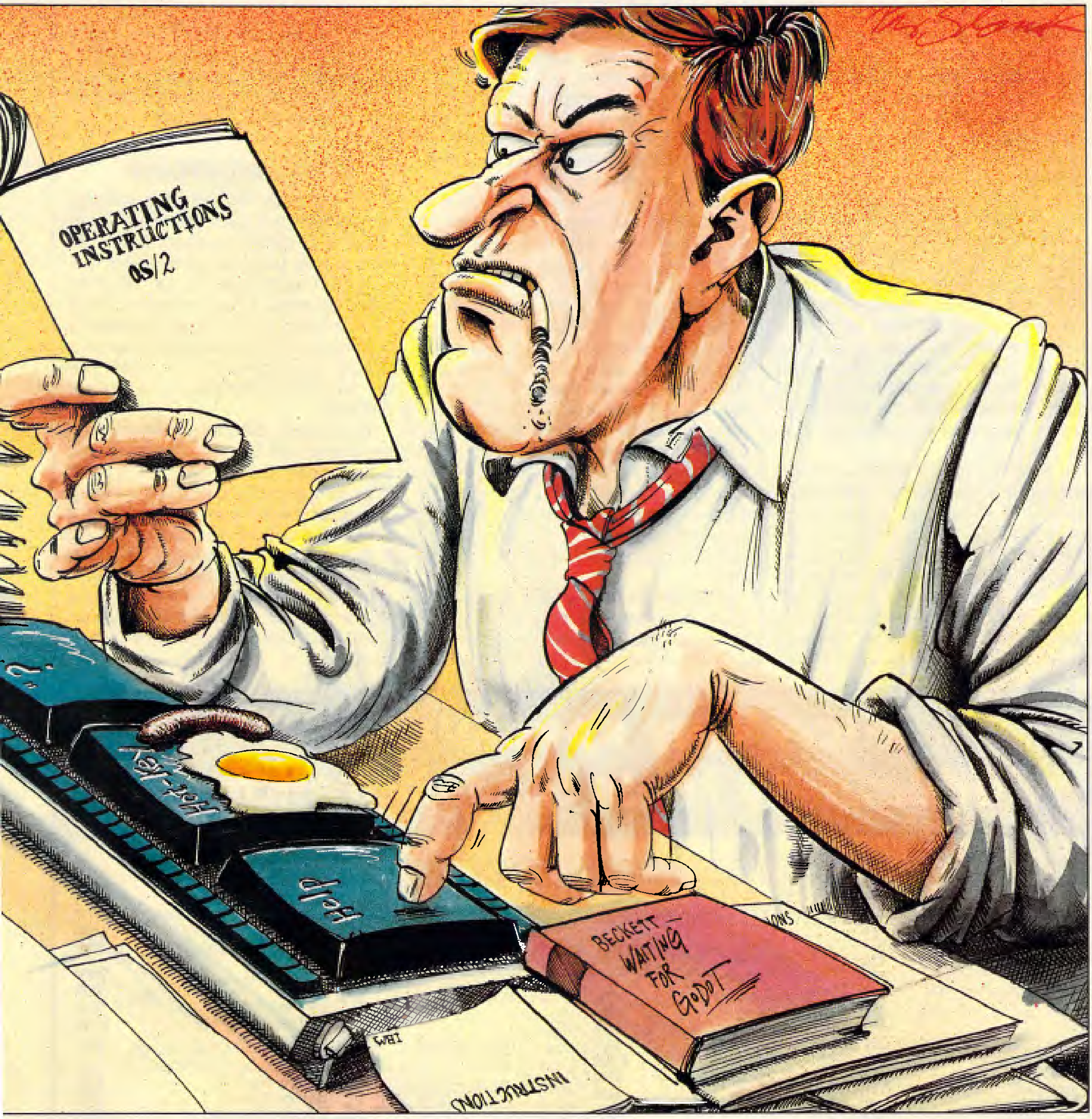
But then come the doubts. OS/2 can run the old PC-DOS software (in a special mode), but any future software which exploits its advanced features will not run under PC-DOS. Software developers must choose *now* — DOS or OS/2. OS/2 is not multi-user, so business users looking for cheaper solutions are still left with a choice from Pick, Unix, BOS or Concurrent DOS. OS/2 will not run at all on 8088 or 8086-based machines; you need an AT or better and your old PC must go in the bin.

But what to upgrade to? Any 80286 machine should run OS/2 (provided it has at least 2Mbytes of memory), but 80286 machines are already obsolete since the introduction of the immensely superior 80386 chip. So go for an 80386 machine, then? Fine, but the version of OS/2 featured here has been written for the 80286 and will not support any of the smarter features of the 80386; *that* version is one or two years away, depending upon who you talk to. Waiting seems to be the name of the game.

> *'The fact that IBM is still shipping EDLIN as the sole system editor in 1988 is profoundly depressing, but fortunately I remain too speechless to utter a serious libel.'*

The version of OS/2 reviewed here is the very first commercial release, 1.0, of the Standard Edition. This is a text-based version of the operating system, with a menu-driven user interface that resembles a simplified form of the ill-fated Topview. Later this year we shall see version 1.1 which includes the Presentation Manager, a Windows-like graphical user interface. 'Standard Edition' distinguishes it from the Extended Edition which will have built-in database management and communications compatible with IBM mainframe operating systems.

I tested OS/2 on an IBM PS/2 Model



80 which is an 80386-based machine though it currently runs OS/2 in the 16-bit protected mode, pretending to be a fast 80286.

Installation

I was supplied with OS/2 already installed on the Model 80's hard disk, but I checked out the installation procedure as a matter of interest. OS/2 is supplied on four of the PS/2's 1.44Mbyte, 3.25in diskettes. The first three disks contain the operating system itself and its external commands and utilities, which number 112 files and over 1.6Mbytes of code. The fourth disk is the installation disk and contains 53 files adding up to 869k. As you will quickly grasp, we are talking about a large system here.

OS/2 is installed by booting the fourth disk which takes you through an interactive installation program. This starts by formatting a partition on the hard disk (if required), and then prompts for the other three disks followed by various options such as the national character set and keyboard, type of mouse, and the configuration. The configuration means the contents of the 'CONFIG.SYS' file, which is generated by the installation program automatically. At a later date you can alter the configuration by merely editing CONFIG.SYS, just as you would in DOS. Despite the size and complexity of the system, IBM has made this initial installation procedure very straightforward and more or less foolproof.

CONFIG.SYS is recognisably descended from its DOS equivalent, in that it contains a number of single-line statements such as DEVICE=xxxx, which loads a device driver at system boot time. However, it has grown much more complex than its DOS predecessor. In addition to the familiar DEVICE and BUFFERS statements, there are a number of new ones, from the obvious DISKCACHE to the less obvious MAXWAIT, PRIORITY, SWAPPATH, MEMMAN, PROTECTONLY, THREADS and TRACE. These control aspects of multitasking and memory management. To set sensible values for these parameters you clearly need to know a lot about OS/2, and the installation program offers a set of default values which will get you running. For the record, the basic CONFIG.SYS generated by my system contained 23 lines.

The PROTECTONLY statement is interesting, as it governs the modes which the CPU is allowed to run in. If you specify PROTECTONLY=YES, then the 80286/386 will only be run in protected mode and can only run OS/2 programs. If, on the other hand, you specify NO, then the CPU can be switched to real mode (in which it emulates an 8086) and this permits DOS programs to be run as well, using OS/2's 'compatibility box' (more of which, later).

The only OS/2 programs I was supplied with were BASCOM, C and COBOL compilers, and MASM, so the use of DOS mode was absolutely essential to preserve my sanity. I was able to install SideKick and use this to edit system files, in preference to the supplied EDLIN line editor; both only work under DOS mode. This raises a tricky point which is anticipated in the *User's Reference Manual*. If you set PROTECTONLY=YES in CONFIG.SYS then you cannot run DOS programs, but since no OS/2 editor is supplied you cannot edit CONFIG.SYS back again, and you are locked out. Renaming CONFIG.SYS and rebooting is the only way out, for then OS/2 cannot find a configuration and sets the default, PROTECTONLY=NO. The fact that IBM is still shipping EDLIN as the sole system editor in 1988 is profoundly depressing, but fortunately I remain too speechless to utter a serious libel.

OS/2 can use more disk space than DOS can, but still only in 32Mbyte chunks. If your hard disk is bigger than 32Mbytes, then you need to use FDISK to set up a primary partition, from which OS/2 boots, and a number of extended partitions which are treated as separate logical drives D:, E:, and so on.

The program selector

When OS/2 has been installed and configured, booting it leads you into a screen called the Program Selector. This is the main control panel of the operating system, from which you can run programs directly or create a new command prompt. You can return to the Program Selector at any time, from inside whatever program is running, by pressing Ctrl-Esc, which acts like the 'hot-key' that pops up a TSR like SideKick.

The Program Selector screen contains two boxes, side by side, occupying most of the screen. The left-hand box is called 'Start a Program', and it contains a menu of programs which can be run merely by selecting them with the highlighted bar cursor. When first booted, the only programs that are present on the 'Start' menu are the OS/2 Command Prompt and a graphics demonstration program called Introducing OS/2. Extra programs

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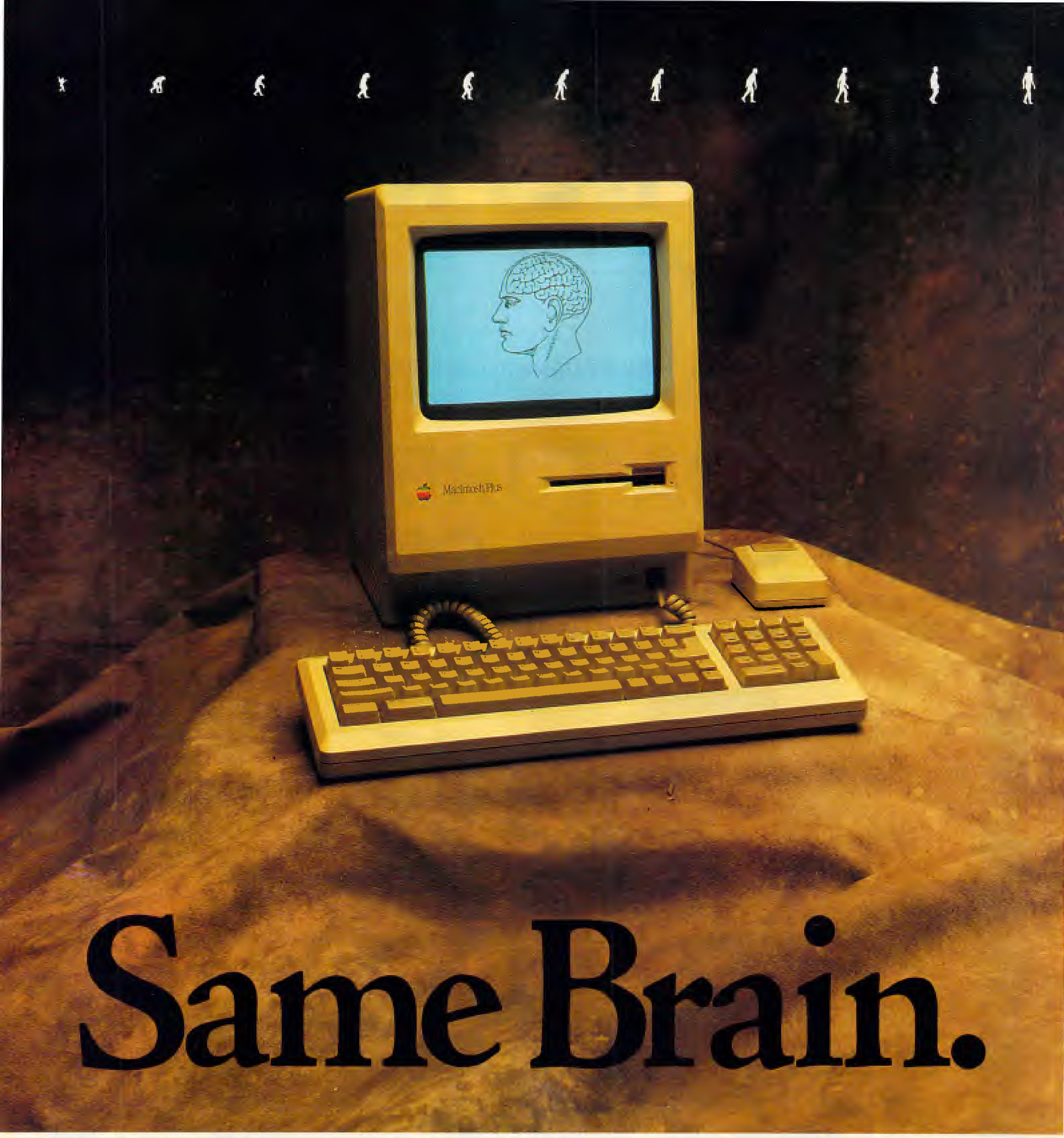

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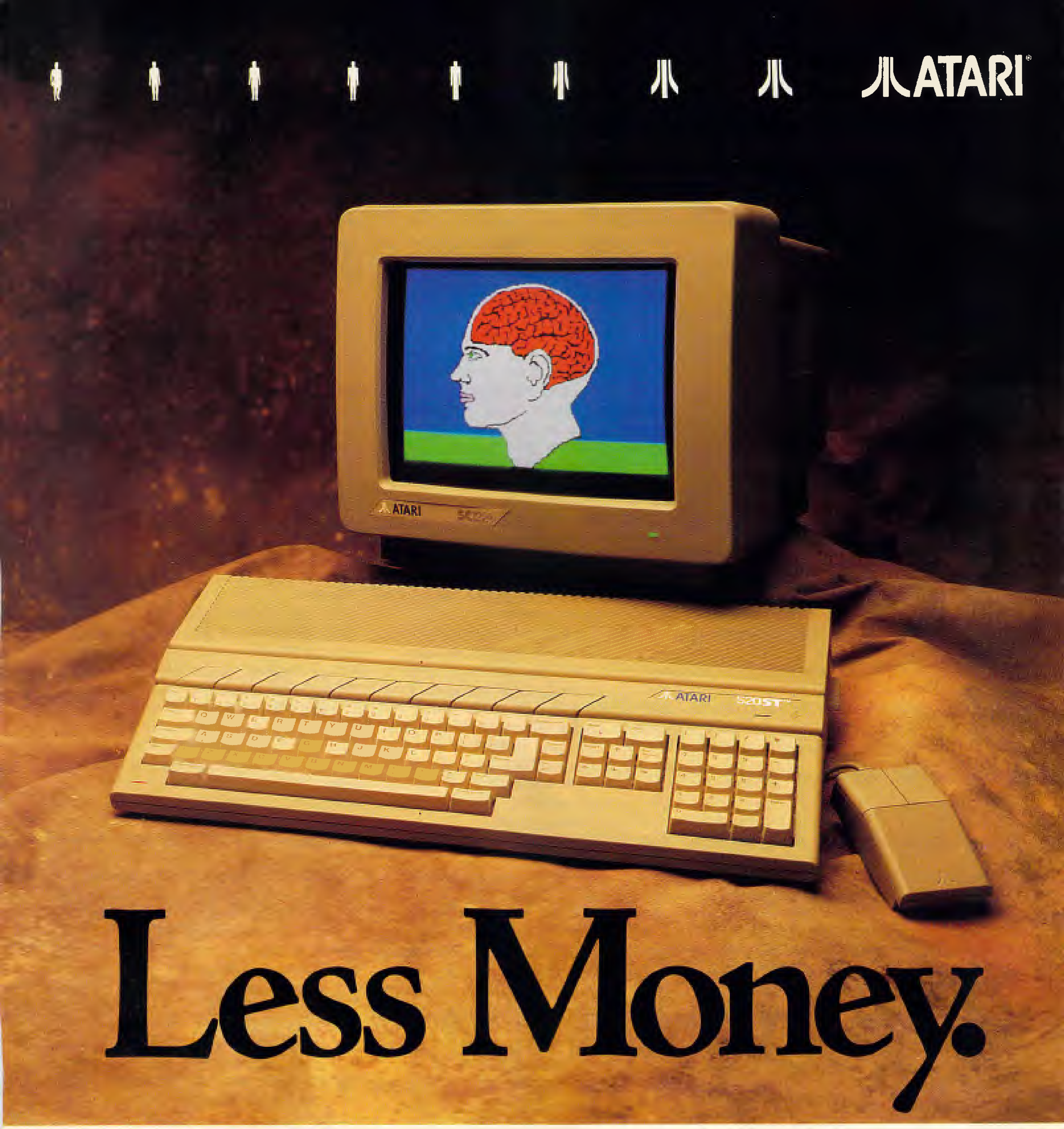

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can be installed by using the 'Update' menu, which pops down from the top of the screen when you either press F10 or point with the mouse. A form is presented into which you enter the required menu title of the program, its full pathname, and any command line parameters it needs.

When a program has been started by selecting it from the Start menu, its name appears in the right-hand box, which is called 'Switch to a Running Program'. Because OS/2 is multi-tasking, there can be many programs in this box at the same time; selecting one puts you back into that program and gives it control of the screen. The OS/2 prompt itself is a program (the command interpreter, called CMD.EXE) and so you can run multiple copies of this, too. From a prompt you can run other programs as usual by typing their names.

To summarise, then, you can run a program either by installing it on the Start menu and selecting it, or by starting a command prompt and typing its name: IBM calls this process starting a new 'session'. Once it has started, pressing Ctrl-Esc returns you to the Program Selector and you can run another program. All the other programs continue to run with full rights, except that you can't see them on the screen; they are not suspended as is the case with TSR programs like SideKick, or with all GEM applications.

There is at present no way of allowing multiple tasks to share the screen. This will come with OS/2 version 1.1 and the Presentation Manager, which will let each task have its own overlapping window on the screen.

To revisit a running program, you can select its name from the righthand 'Running' menu, whereupon it returns to the screen instantly. There is also a short-cut to visit another session without going through the Program Selector screen; pressing Alt-Esc cycles you through all the sessions currently running one after another. Like Ctrl-Esc, this is a hotkey which works from inside any application.

The DOS emulation works rather differently. If DOS is enabled (PROTECTONLY =NO), it appears in the Program Selector's right-hand box as an already-running program called 'DOS Command Prompt'. This program cannot be stopped, and you cannot start further copies of it since it does not appear on the Start menu. This reflects the way that OS/2 handles DOS emulation; it reserves a 640k 'box' at the bottom of memory for DOS programs alone and will not release any more memory to DOS. In contrast, OS/2 tasks run above the 1Mbyte mark, and you can run as many as there is memory for (subject to certain limits on threads, see below).

The DOS prompt behaves just like PC-DOS 3.3, complete with all its utilities and even its own AUTOEXEC.BAT that is executed when you first select it, rather than at boot time. However, when you switch away from the DOS box to an OS/2 screen, the DOS application is suspended and does *not* continue to run in the background.

Due to the new OS/2 disk format, the range of software that I could try was limited; but most things I tried worked perfectly, including PC-Write, PC-Tools, SideKick and Notebook. Not all old DOS software works, and you are advised to try any application that you *must* carry over to OS/2 before purchase.

OS/2 boasts more extensive online help facilities and better error reporting than PC-DOS (which is not too difficult to achieve). A strip across the top of the screen called the 'Help line' can be enabled or disabled by the HELP ON and HELP OFF commands. When you are at the OS/2 prompt, for instance, it reminds you of the use of Ctrl-Esc. In the Program Selector it offers both the Update menu and several Help screens which are accessed by pressing F1. One irksome omission is some visual indicator to identify which session you are in; other multi-task operating systems like Digital Research's Concurrent DOS put a number in the prompt. When you have several sessions open, you can soon forget where you are.

The OS/2 command line error messages are more verbose than those in PC-DOS, and also clearer; however, I am not sure that OS/2's 'SYS 1041: the name specified is not recognised as an internal or external command, operable program or batch file' is any less irritating than good old 'Bad command or file name'. Any error message in OS/2 can be expanded still further by typing 'HELP' <errornumber>', whereupon two paragraphs are displayed describing the *explanation* of the cause of the error, and the *action* to be taken.

Despite these effusive messages, there are still a few little horrors in store. When you install the COM2.SYS device driver to run the mouse, a message politely informs you that the 'COM2 port did not install' and 'device adaptor could not be found'; this signifies that all is well because the mouse has grabbed the COM2 port. Perhaps, on reflection, there is a certain Beckett-like logic to this.

New commands

The command interpreter of OS/2 version 1.0 has been designed to be very familiar to PC-DOS 3.3 users, so many of the commands are identical in both name and action. You type 'DIR' to see a directory listing, 'TYPE' to view the contents of a text file, 'CD' to change directory, 'DEL' to delete files and 'COPY' to copy them. There are, however, a number of new commands that relate to multi-tasking and fault tracing, which I shall briefly describe here.

Perhaps the two most important of the new commands are 'START' and 'DETACH'. START <name> starts up a new task called <name>, as if you had selected it from the Program Selector. It creates a new session and command interpreter for the task, different from the one from which START is executed; to start a task in the current session, you need only type its name.

If this sounds obscure, consider a batch file containing the following instructions:

```
START TOM
START DICK
HARRY
```

When you run this batch file, it will run TOM and DICK in two new sessions, and run HARRY in the current session: that is, it leaves you in HARRY. To see TOM and DICK running, you would need to press Alt-Esc twice. START can execute batch files as well as programs.

DETACH performs a similar role for non-interactive programs — that is, programs which do not perform any keyboard or screen I/O. It does not create a new command interpreter for its task, but runs in pure background mode. Obviously, such a task needs to do some kind of I/O (unless it is a transcendental meditation task) and this has to be provided by re-direction to files. For example, if you have a program called LOGGER which reads in data from an instrument, you can run it in the background with output to a file by typing 'DETACH >MONDAY.DAT LOGGER 2>&1'. '>MONDAY.DAT' redirects standard output to file MONDAY.DAT, while the '2>&1' redirects the standard error channel to the same file; otherwise, any error messages would attempt to go to the display.

OS/2 contains some sophisticated error tracing features resembling those of a minicomputer, and which become necessary with operating systems this large and complex. 'TRACE' permits selective tracing of system events (such as disk reads and writes, or starting new sessions). Major system events are assigned event codes between 0 and 255, and TRACE ON 23,45 would instruct OS/2 to record the time of occurrence of all events of types 23 and 45. The *User*

Manual doesn't include the event codes, which are to be obtained from 'your IBM service representative'.

'TRACE ON' with no parameters traces all events, while 'TRACE OFF' can disable tracing of all or some events. The trace data is stored in a memory buffer whose size is set by the 'TRACEBUF' command, but defaults to 4k. Both commands may also be included in a CONFIG.SYS to enable tracing from boot-up.

To see the trace you have to issue a 'TRACEFMT' command which formats the buffer contents and sends them to the standard output, which you can redirect to the printer or a file. Then 'your IBM service representative' can use the printout to diagnose faults.

A third problem-related command is 'CREATEDD', which creates a Dump Disk. This is a specially formatted disk for use with the standalone dump facility. In the case of a system crash which did not wipe the memory-resident dump routines, you can dump the entire contents of memory to a series of diskettes for use in fault diagnosis. The dump is started by placing the dump diskette in the drive and pressing Ctrl-Alt-NumLock-NumLock. CREATEDD creates only the first of such a series of disks, the rest being created during the dump itself as promoted. This initial dump disk pretends to be full to stop you from using it for any other purpose.

'PATCH' is a new command which applies patches to OS/2 and related programs, and is a highly simplified substitute for DEBUG. PATCH has a fully automatic mode which patches a program using a file of patch data distributed by IBM or another software vendor; it is invoked by, for example, PATCH BUGFIX /A. If the /A is omitted, then PATCH works in interactive mode, when it resembles the E option from DEBUG, and permits you to enter patches by hand, prompting for offset values.

For a novice user PATCH is easier to use (and more difficult to do damage with) than the old DEBUG, but for the experienced programmer it lacks many essential features, such as search and assemble. DEBUG is no longer supplied.

A multi-tasking environment like OS/2 presents special problems in the area of I/O, because multiple running programs may want to use the printer or the serial port at the same time. To handle this gracefully, all I/O must be done through operating system services which queue the various tasks to wait their turn. However, old programs written for single-tasking DOS may not observe the necessary etiquette, and

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the more brutal of them may seize ports directly, bypassing the operating system completely.

SETCOM40 is a command to cope with this situation. It allows a DOS program to directly access COM ports, bypassing the OS/2 device drivers. The sort of programs that are likely to need it are communications packages and programs that use a serial mouse or printer. Once you have given a port to DOS — say, by issuing SETCOM40 COM1=ON — it is up to you to make sure that no OS/2 program tries to use COM1 by not switching out of DOS mode till you have returned the port.

SPOOL is the program that manages the queue for the printer. Various tasks may all print at the same time, each thinking that it has the printer to itself. In fact, SPOOL catches the outputs from the tasks, separates them, and stores them as temporary files in a directory which is nominated as a parameter in the command. These files are then printed one after the other, resulting in orderly printing instead of the chaos of jumbled outputs that would otherwise arise. There is seldom any need to run SPOOL interactively, and it is usually executed by CONFIG.SYS at boot-time, with the default spooling directory called \SPOOL.

If you have several printers attached, you can run multiple copies of SPOOL using DETACH. Again, there may be problems for DOS programs that were not written with spooled output in mind; the usual symptom is that they will not print anything at all until you exit from the application. In such cases, OS/2 allows you to press Ctrl-Alt-PrtScr which sends an end-of-file to the spooler to force it to print the file.

The final command I'll mention is 'CHCP', the CHange Code Page command. OS/2 supports multiple character sets through the device of 'code page' switching. A code page is just a national character set stored in RAM, and is identified by a three-digit number. The system can be configured to have two code pages in memory at a time, and the 'CHCP <nnn>' command switches from one to the other. Normally, you will have your national character set as one code page, and the multi-lingual code page, number 850, as the other. The latter has some characters for most European, US and south American languages and is used on IBM mainframes and minicomputers. Printers can also be configured to work with different code pages.

The OS/2 batch processor has all the features of the one in DOS, plus the major addition of the very useful 'SETLOCAL' and 'ENDLOCAL' commands. SETLOCAL saves the values of all environment variables, allowing you to alter them locally and have them automatically restored to their previous values when ENDLOCAL is reached. So, a batch file to run a compiler might completely alter the PATH and DPATH for the duration of its execution without messing up your default/environment.

The command line processor itself has also been beefed up considerably in OS/2. The redirection (>,<, >>) and pipe operators (¦) are all retained, but in addition there is conditional processing using AND (&&) and OR (¦¦) operators, plus grouping and separating of commands with () and &.

When two commands are separated by &&, the second is only performed if the first succeeds; success is defined as terminating in a non-error output. For example, the command line 'DIR DICK.DOC && MD DICK' says: 'If there is a file called DICK.DOC in this directory, then make a subdirectory DICK'.

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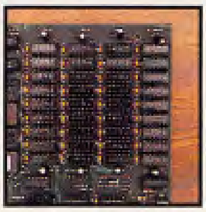

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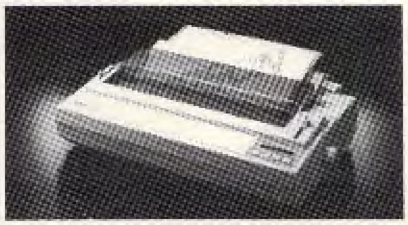

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On the other hand, 'DIR DICK.DOC || MD DICK' says: 'Make the subdirectory DICK only if there is not a file called DICK.DOC' (strictly speaking, this is an XOR operation rather than OR).

Multiple commands may be given on one line separated by &, when they will be executed strictly from left to right. DIR A: & DIR B: displays the directory list for A: followed by that for B:, both *after* the second command has run. Parentheses may be used to group such commands to ensure the correct order of execution, leading to sequences like 'DIR DICK.DOC && (MD DICK & COPY DICK.DOC DICK & DEL DICK.DOC)'.

These and other enhancements create what amounts to a job control language, and allow very powerful batch programs to be written. Used in conjunction with PATCH, for example, it should allow IBM to distribute disks which apply complex upgrades and bug-fixes without any user intervention.

Memory management, multi-tasking & programmer's interface

Much has been written since April 1987 about the internal workings of OS/2, so I won't go over it again in great detail. I'll just point out some of the novel features.

OS/2 uses a more dynamic form of memory management than PC-DOS does, and there are two basic memory maps. In DOS mode, the bottom 1Mbyte is devoted to BIOS ROM and the 640k block of DOS working memory; video RAM also lives in this section. In OS/2 mode, up to 16Mbytes of physical memory can be addressed by OS/2 programs, and it is also possible to run DOS-compatible, so-called 'family' programs (programs written using a restricted set of OS/2 functions) in the upper part of memory. Family applications will provide a bridge for software developers in the short term; by following the rules you can write family applications now using DOS 3.3 compilers, and then recompile them more or less unchanged under OS/2 as the compilers become available.

OS/2 supports a limited form of virtual memory, allowing you to run programs that exceed the physical memory size. In IBM-speak this is called 'storage overcommitment', and there are three levels involved.

Firstly, OS/2 can recognise that a program segment is no longer being used and discard it, using the memory for another program.

Secondly, OS/2 can swap out a program segment into a special file called '\SWAPPER.DAT' which the installation process creates in your root directory. If the segment is needed again, it must be swapped back in place of another segment. Obviously, this process can slow down execution somewhat, but with hard disks as fast as that of the Model 80, you will scarcely notice.

Thirdly, OS/2 can rearrange memory to free more space. As segments are discarded or swapped out, memory becomes fragmented with lots of small holes all over the place. OS/2 can compact the memory by moving things around to make the free space into a contiguous block, until it has enough to satisfy a program's request.

Some programs, especially real-time programs and timing-dependent communications programs, cannot tolerate the uncertain delays caused by swapping and moving memory, so these features can be controlled using the 'MEMMAN' command. It is possible to enable and disable both swapping and compaction separately with lines like 'MEMMAN NOSWAP NOMOVE'.

The multi-task scheduler in OS/2 uses a fairly sophisticated strategy compared to the crude background facilities used in Windows and the Mac Multi-finder. The unit of processing under OS/2 is called a 'thread', which is a concurrent task that forms a component of an application. All tasks (or, to be exact, threads) have a priority assigned to them, and multi-tasking is achieved by giving out slices of processor time to all threads with the same priority on a round-robin basis. An application can belong to one of three classes of activity: time-critical, regular or idle-time, in descending order of 'importance'. There are 32 priority levels within each class. The latter class corresponds to the Windows/Multi-finder type of background process that is only run when the system is doing nothing else — for example, waiting for a keystroke.

The priority of regular tasks is dynamically variable, and OS/2 can alter the priority of a task to make sure it is run within an acceptable time. The CONFIG.SYS command 'MAXWAIT' determines the length of time a process can be made to wait before it is uprated to a higher priority — that is, how long it can be left out in the cold by higher-priority processes. 'TIMESLICE' alters the actual size of a single timeslice and can be used to fine-tune the system. 'PRIORITY' enables or disables the dynamic variation of priorities. (Incidentally, OS/2 can only handle up to a maximum of 255 threads, which places a limit on the number of concurrent applications that can be run. 255 sounds a lot, but

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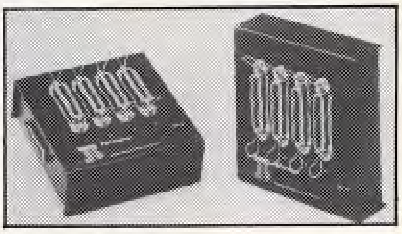

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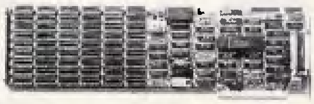

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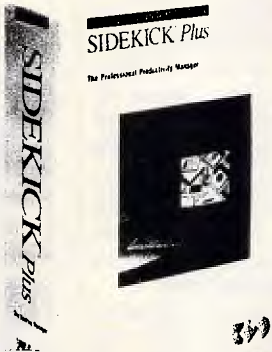

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Performance

Testing the performance of an operating system in any useful way is more difficult than the normal Benchmarking exercises that *APC* tackles. Nevertheless, it seemed like a good idea to try to assess the relative performance of OS/2 compared to PC-DOS 3.3 when running the *APC* Benchmarks. The only language I had in common with DOS 3.3 and OS/2 was the new IBM C/2 compiler, which can compile objects for either operating system. This compiler came complete with Microsoft's Codeview tracer/debugger, though the latter only runs in the DOS mode.

As a further comparison between DOS 3.3 and OS/2 DOS mode only, I also ran the Benchmarks in interpreted BasicA.

APC Benchmarks in BasicA

	OS/2 DOS Mode	PC-DOS 3.3
Intmath	0.60	0.54
Realmath	0.82	0.82
Triglog	2.60	2.60
Textscrn	18.01	16.80
Grafscrn	3.62	3.46
Store F/D	11.25	11.25
Store H/D	2.41	3.18

You can see that there is little difference, suggesting there is no penalty for running DOS software under OS/2 DOS mode. Indeed, the hard-disk access appears to be significantly faster under OS/2 than under DOS in this case.

However, this difference disappears in C/2; the timings for OS/2 native mode, OS/2 DOS mode and PC-DOS 3.3 being substantially identical.

APC Benchmarks in IBM C/2

	OS/2 Native	OS/2 DOS Mode	PC-DOS 3.3
Intmath	0.007	0.007	0.007
Realmath	0.42	0.41	0.43
Triglog	7.80	7.88	8.01
Textscrn	16.01	15.82	16.20
Grafscrn	N/A	0.32	0.29
Store H/D	0.68	0.69	0.70

A question which fascinates me is this: how much of the 2Mbytes of memory fitted to the Model 80 is available to user programs under OS/2? This proved impossible to determine with the available software. Normally, I would run a little utility called MEM.COM, or, failing that, Norton's or PC-Tools; or, in desperation, CHKDSK. I had none of the aforementioned tools under OS/2 and CHKDSK has been modified so that it shows disk space only.

I was able to run eight copies of the OS/2 command shell before swapping to the hard disk started to occur and opening a new session became noticeably slower (though still only around a second). The shell file CMD.EXE is 57k in size, which would mean that about 456k of RAM was occupied. At 13 sessions, an error box opened up saying that the maximum number of programs was now running and would I close something down in order to proceed. Surprisingly, after closing down one session, I was able to run PATCH in each of the 12 remaining sessions; perhaps PATCH employs code sharing and only one physical copy is loaded, but in that case perhaps CMD.EXE does too. This way madness lies.

one application could use 20 or more threads).

The programmer's interface to OS/2 is a huge improvement over the low-level software interrupt system of PC-DOS. All OS/2 services are called by their names (for example, DosCreateThread, DosGetMessage) and parameters are passed to them on the stack instead of in processor registers. This latter feature is a great step towards portability as the operating system is no longer tied to a particular chip architecture. On the other hand, there are now over 900 OS calls

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to learn as opposed to 90 under PC-DOS.

Another feature provided by OS/2 which excites many programmers is the dynamic linking of modules. Under DOS, all the modules of your program have to be linked into one large .EXE file before it can be loaded and run, which puts strains on the writing of large programs. Under OS/2 it's possible to leave linking until run time; a program can have unresolved external references which are satisfied by loading a new module while the program is running. This means that code which is very seldom used may never need to be loaded at all, thereby saving memory; and that code which is used very often can be shared by a number of programs, saving disk space. Libraries of linkable code can be updated without having to recompile all the applications which use them. In short, it makes writing and running very large programs much easier.

Conclusion

There is no question that OS/2 remedies many of the limitations of PC-DOS. It provides an amount of memory which should not prove constricting for two or three years, and the promise of more with the 80386 version. It has a sophisticated system of multi-tasking which, even in version 1.0, is quite easy to use at the command level. It has many enhancements in the area of command and batch processing, dynamic linking of modules, and more. It provides far more facilities for professionals than PC-DOS ever did. Why, then, do I feel so depressed about it?

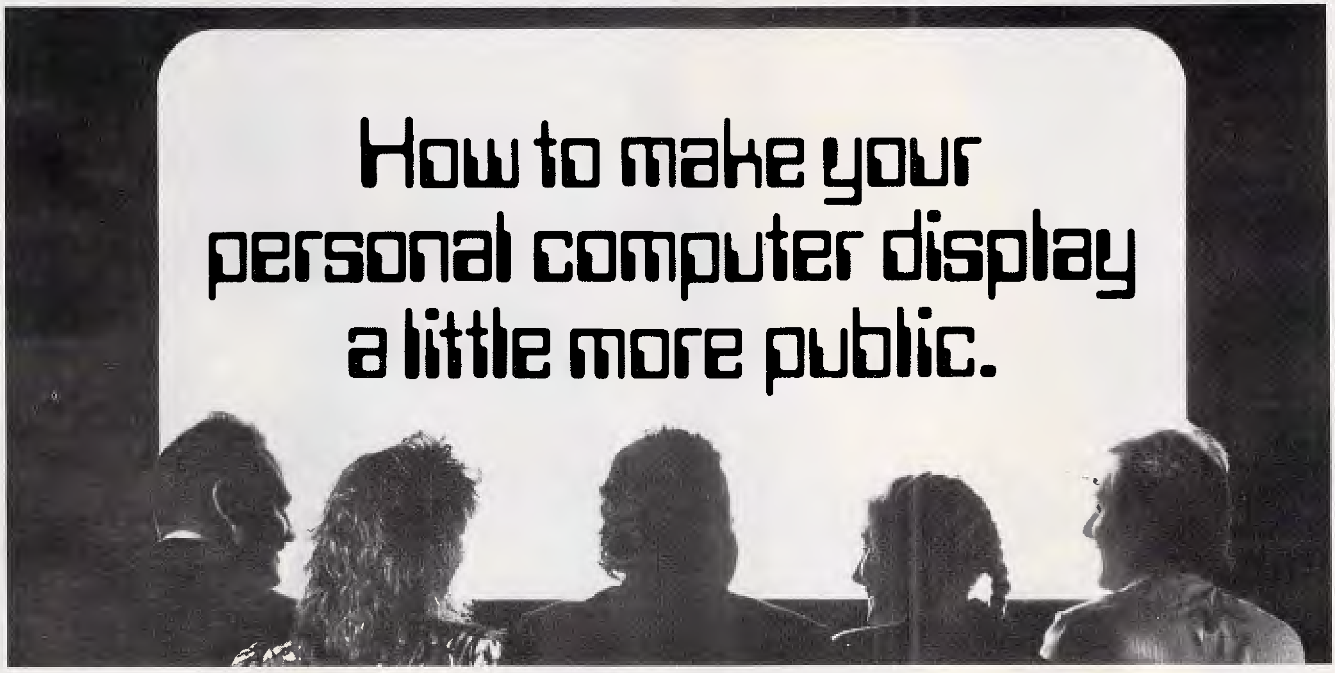
The answer is that the huge, complex OS/2 is a big step forward into a realm I do not wish to enter. OS/2 is a minicomputer operating system masquerading as a personal computer operating system, just as the Model 80 is a minicomputer masquerading as a PC. OS/2 will no doubt be excellent for downloading IBM mainframe files to corporate spreadsheets, though a recent report commissioned by Lotus suggests that even large corporate purchasers are being quite wary about the new system, and barely 10 per cent were planning a wholesale changeover in 1989. Most (40 per cent) suggested they would be taking on OS/2 for specific applications, not to replace DOS.

I am not really qualified to say whether or not OS/2 is a good minicomputer operating system, having cut my computing teeth on a Commodore Pet and never having worked a single day in the DP industry. In the hairy early days of *APC*, we used to swear blood oaths never to use a computer that needed to stand on the floor, and not to trust anyone who uses 'port' as a verb. IBM, on the other hand, has always wanted to sell us minicomputers; the PC was a highly successful aberration, and industry myth has it that many of the crippling limitations of the original PC were deliberately imposed so that it would not impinge too seriously on mini sales. Now the 80386 has allowed the company to close the circle with a mini/PC.

My own ideas of what my next operating system should look like are as far removed from this leviathan as they are from the patronising hieroglyphics of the Macintosh. I've glimpsed bits of what I like in programs such as SideKick, ProComm, SuperKey, Automator mi and QuickDOS, but nothing as yet which puts them all together. I do know that it is unlikely to come from IBM.

Estragon: 'Shall we go...'
Vladimir: 'Yes, let's go...'
(They do not move. Curtain.)

END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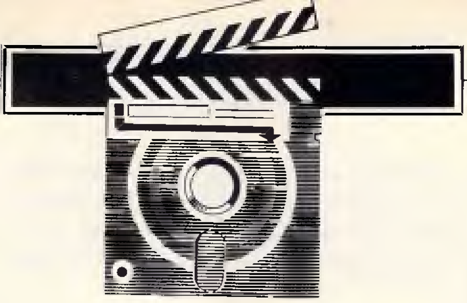


SideKick Plus

Addicts of Borland's memory-resident SideKick program for the IBM PC and compatibles may be sitting comfortably now; but the enhanced version, SideKick Plus, has much to offer. Dick Pountain was very impressed with its ease of use and increased power.

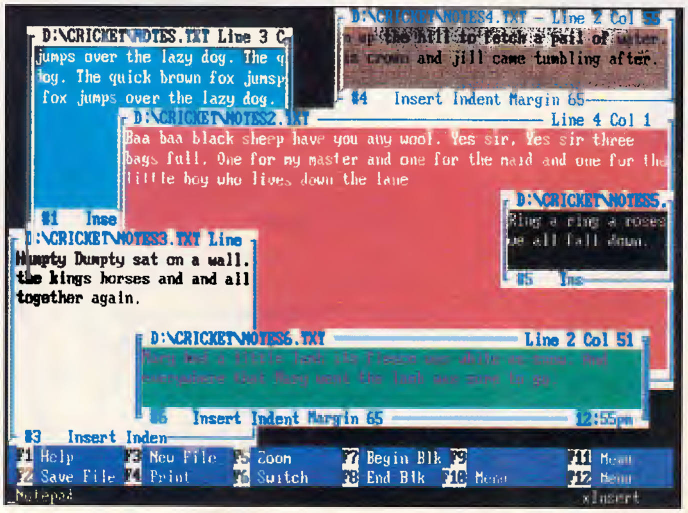
Before proceeding with this review of Borland's SideKick Plus, I must declare an interest; namely that I am a hopeless addict of the original SideKick. Since I first laid eyes on the program (in a review for *APC* some years ago) it has never been off my computer, and I estimate that I use one or other of its component parts at least 50 times a day, every day.

While ruminating on the reasons for SideKick's success, it came to me that in fact all it does is what the operating system ought to be doing; it's an extension which drags PC-DOS, kicking and screaming, from the gloomy Teletype-based world in which it was born into the world of colour and memory-mapped video which the hardware supports. Of course, hardware has now moved on into new realms of bit-mapped graphic displays and soft fonts, so SideKick represents a character-based compromise between the CP/M style scrolling 'glass teletype' and the fully graphical interfaces of GEM, Windows and the Macintosh.

For example, the Notepad's file window provides a handy (if limited) way of locating files without quitting your present application. The Dialler serves admirably for online documentation and for other reference data such as international dialling codes, metric/imperial conversions and the like; and Notepad's cut-and-paste facility in conjunction with disk editor like Norton Utilities has more than once enabled me to retrieve lost data files.

When the news of SideKick Plus first arrived, I made up a shopping list of the improvements I would like to see in it. First, by a long way, was the provision of multiple Notepad windows, followed by a more powerful database function in the Dialler, and a more extensive Appointments calendar with an alarm facility. Borland has provided all these things and much, much more. SideKick Plus is a very ambitious product indeed, to the point where it can no longer be considered a resident utility, but rather has become a whole operating environment; it even has hooks for third-party software houses to write applications to run under it. It is consequently much larger and very much more complex than the old SideKick. Despite my initial forebodings that Borland might have gone 'over the top' with SideKick Plus, I discovered that the same intelligence and elegance of design that initially attracted me are still there, and certain new features like the customisable menu system represent a real breakthrough in user interface design. Within a few days SideKick Plus became even more indispensable than SideKick, and now the idea of going back to a single Notepad is unthinkable.

This review was performed on various preliminary versions of the SideKick Plus software (SK Plus from now on for brevity), and was completed before the first release version became available. Nevertheless, all the parts of the system were complete and working in the last version (0.83 Beta) that I used, and it



```
D:\CRICKET\NOTES.TXT Line 3 C
jumps over the lazy dog. The q
dog. The quick brown fox jumsp
 fox jumps over the lazy dog.
#1   Inse

D:\CRICKET\NOTES4.TXT - Line 2 Col 55
n up the hill to fetch a pail of water.
is crown and jill came tumbling after.
#4   Insert Indent Margin 65

D:\CRICKET\NOTES2.TXT ———————— Line 4 Col 1
Baa baa black sheep have you any wool. Yes sir, Yes sir three
bags full. One for my master and one for the maid and one for the
little boy who lives down the lane

D:\CRICKET\NOTES5.
Ring a ring a roses
we all fall down.
#5   Ins

D:\CRICKET\NOTES3.TXT Line
Humpty Dumpty sat on a wall.
the kings horses and and all
together again.
#3   Insert Inden

D:\CRICKET\NOTES6.TXT ———————— Line 2 Col 51
#6   Insert Indent Margin 65 ———— 12:55pm

F1 Help       F3 New File  F5 Zoon    F7 Begin Blk  F9         F11 Menu
F2 Save File  F4 Print     F6 Switch  F8 End Blk    F10 Menu   F12 Menu
Notepad                                                         xInsert
```

Up to nine Notepads can be opened simultaneously with SideKick Plus. The active window has a double line as its border. Switching between active windows is easily achieved with the F6 function key was stable enough to use for serious work — if not entirely bug- free.

Because of its large size and the memory limitations of PC-DOS, SK Plus employs a clever and complex system of memory management to squeeze itself into less than 640k. Its size also prevents it being distributed as a single .EXE file, as it exceeds the capacity of a 360k PC disk; this also means that it is impossible to use without a hard disk. SK Plus is distributed as a number of libraries, on three disks, from which you build a system including and excluding parts as you require. The end result is a .EXE file which can be loaded at boot-up time and remains partly memory resident; a main menu, similar to that in the original SideKick, pops up when you press the CTRL-ALT keys simultaneously.

Applications

SideKick Plus comes supplied with seven basic applications, two more than the original SideKick. These are the File Manager, Notepad, Outlook, Phonebook, Time Planner, Calculator and ASCII Table. Of these the File Manager and Outlook (a ThinkTank-style outline editor) are wholly new, and the other five are greatly improved versions of those in the original SideKick; Phonebook is the new Dialler and Time Planner is the new Calendar.

File manager

The File Manager, as its name suggests, is a DOS shell program for managing files. It performs a similar function to standalone utilities like Xtree, QuickDOS or the Norton Commander, and shares features with all of them. It takes the place of the file window in the old SideKick, appearing on the screen automatically whenever a file name is requested, and you reply ambiguously (that is, with a directory name, a wildcard specification or nothing at all). The File Manager windows can be on the screen at the same time, which is very handy for people with several hard disks or partitions.

File Manager supports all the housekeeping functions you would expect, such as Rename, Delete, Copy, Move and Modify file attributes. It enables you to mark a group of files and perform a function on all of them, equivalent to 'tagging' in Xtree and QDOS. Also, floppy disks can be formatted from inside an application, which will delight users of certain hostile word processors. The directory listing in the File Manager window can be sorted by name, extension, size or date and restricted by a wildcard specification. File contents can be viewed in ASCII or hex format; the search function finds files across directory boundaries on a hard disk; a string search finds all files containing the specified string. Unlike Xtree and QDOS and similar utilities, File Manager cannot show you a graphic tree diagram of your directory structure.

Notepad

The Notepad is not very different in its fundamental workings from that in old SideKick. The biggest difference is that you can have up to nine of them. When you hit N for Notepad in the main menu, a submenu appears showing the nine Notepads and the names of any files that are attached to them. You can select one from this menu to open. Notepad windows can also be opened directly by pressing the ALT key and a number from 1-9.

When you have several Notepads on

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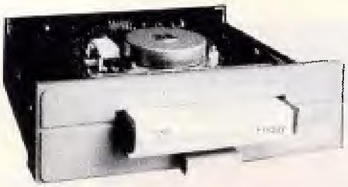

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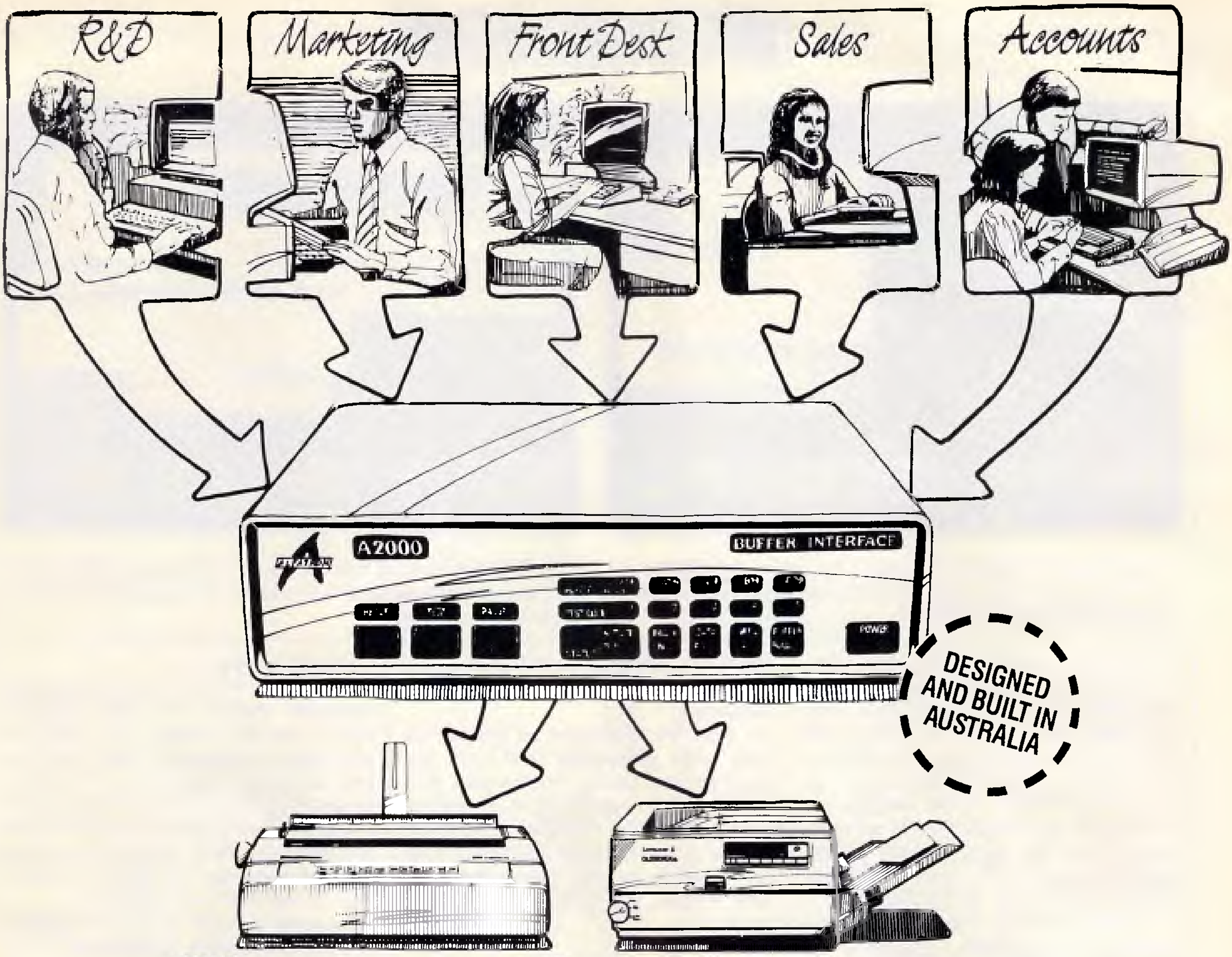

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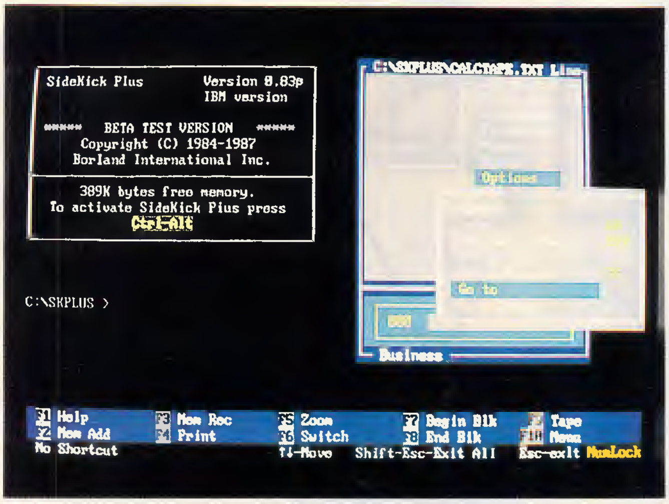


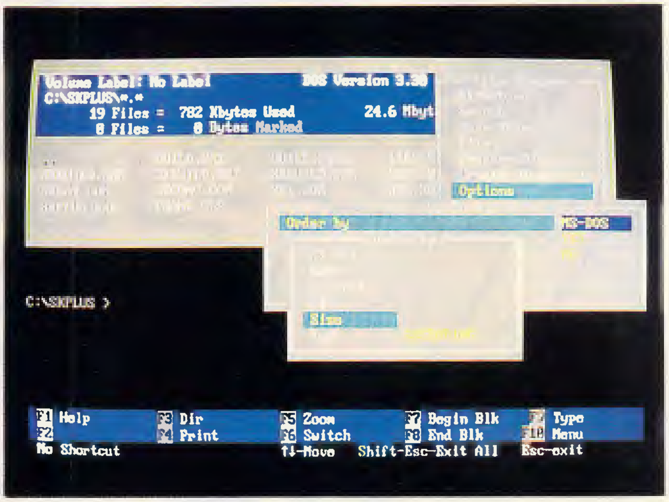
```
SideKick Plus           Version 0.83p
                        IBM version

*****   BETA TEST VERSION   *****
     Copyright (C) 1984-1987
   Borland International Inc.

      389K bytes free memory.
 To activate SideKick Plus press
             Ctrl-Alt

C:\SKPLUS >
```

The calculator function of SideKick Plus allows the printout tape to be pasted into a notepad document. A variety of calculator modes can be selected



```
Volume Label: No Label              DOS Version 3.30
C:\SKPLUS\*.*
      19 Files =  782 Kbytes Used          24.6 Mbyt
       0 Files =    0 Bytes Marked

C:\SKPLUS >
```

The SideKick Plus file manager allows directories to be sorted by filename, extension, size or date. It also supports File searches and disk formatting

the screen at once, the top or active one is indicated by a double line as its border, while all the others have single ones (this indication is used throughout SK Plus). A Notepad can be removed from the screen by pressing ESC when it is the active window; its file remains attached and open, ready for it to be reactivated. You can cycle through all the visible Notepads in the order they were opened by pressing the F6 'Switch' key, or bring a particular one to the top by pressing ALT <number>. The border of each Notepad window is crammed with information, including the number of the Notepad, the filename currently attached, the current time and the status of various toggles like Insert/Overwrite; there is also a little indicator that shows whether the file contents have been changed.

Changing the file attached to a Notepad is accomplished by pressing F3 and typing its name, or by using the File Manager. You are warned, as before, about saving files which have been altered, and there is an option to save *all* Notepads, which is very handy when shutting down with several active. Default files can be assigned to Notepads, so that they will always start up with these files attached. I found it very convenient to keep AUTOEXEC.BAT and my address database permanently attached to two Notepads.

The main editing commands remain unchanged, based on those of WordStar. There are, however, some extra ones, like greatly enhanced search options (including 'sounds like' matching using the Soundex algorithm), better tab and margin controls, and the option to switch off the automatic creation of .BAK files (which makes me very happy indeed). Dot commands are supported for headers, footers and conditional pagebreaks.

In short, the Notepad is as powerful as many word processors, and had I not been spoiled by my customised PC-Write I would happily use it for serious writing. One area Borland has not enhanced is the memory management of the Notepad; its files are still entirely RAM resident and limited to around 54k in size.

Outlook

Outlook is a pop-up outline processor, and the best outline processor I've tried, comfortably beating ThinkTank, PC-Outline and Ready! in elegance and ease of use, and rivalling Mac programs like More. As with the Notepad, you may have up to nine Outlook windows open at the same time with different files. Outlook allows you to enter and manipulate structured outlines, composed of headlines, subheadings, sub-subheadings, and so on. There are the usual pruning functions for moving blocks of headlines from one level to another and from one part of the outline to another.

There is no word-wrap, every line being treated as a separate headline (of arbitrary length). If you want a substantial quantity of word-wrapped text to appear under a headline, you use the 'Attached Note' command which pops up a window identical to a Notepad window and allows you to associate any amount of text with the headline; this note text is stored in the same file as the outline. This scheme neatly overcomes the contradiction between the ways of handling word-wrapped text and structured headlines that messes up the user interface of many outliners.

Headlines which have associated notes are marked with three horizontal bars in the right margin. You can have any number of attached notes in an outline, but they seem to be limited to around 5k per note. Nevertheless, this is a way of creating larger documents than the Notepad alone permits; you must divide the text up into sections smaller than 5k with their own subheads.

The entry of headline text into Outlook is delightfully simple. Pressing RETURN gives you a new line at the same level, while ALT RETURN gives you a new line at the next level down. Pressing TAB while on a line demotes that headline one level, and SHIFT TAB promotes it. Using these simple keystrokes, structured text can be typed as fast as into an ordinary word processor. The text under a headline can be folded away and hidden by pressing the Keypad key and revealed again by pressing '+'. If you prefer you can select 'browse mode' in which the text under a headline automatically unfolds when the cursor moves onto it, and closes again when you move out.

Outlook can import text from other sources, and will try its best to structure such text as an outline. For example, if you read in a Turbo Pascal source program, it correctly identifies BEGIN. . . END blocks and structures the text so that only the procedure names are visible at the top level. Printing is flexible, with a variety of numbering formats and automatic generation of a table of contents.

A most impressive feature of Outlook is the diagram drawing facility. By selecting the 'Insert Diagram' command, you can 'paint' block diagrams with the cursor

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keys or mouse, using the IBM extended box characters; corners and intersections are automatically closed correctly. Any outline at all can be automatically printed out as an organisation chart, merely by selecting the 'Output Chart' command; each headline is printed in a box, arranged in a tree structure from the top down. You can alter the default width and depth of boxes used.

Many charts will be too wide to print in one piece, so Outlook helpfully chops them up into slices the size of your printer paper, which can be stuck together later.

Phonebook

The Phonebook has come a long way from the crude Dialler in old SideKick. For one thing it has acquired a fully-featured communications package which can work in the background; you can upload and download files while continuing to work on your PC. The Phonebook is now a proper database program, with indexed searching in place of the glacially slow sequential search of Dialler, and with structured records in place of single-line addresses.

The Phonebook window is divided into three columns — marked Index, Name and Phone Number — and each entry occupies a single line. This, however, is only a restricted view of the underlying record, which may have many more fields, for name, address, comments, and so on. Eight pre-set forms are supplied, covering commonly used address formats, mailing labels, personal and business and Email services, but the user cannot define new forms which is a definite drawback.

The indexed search is very quick but there is an even quicker partial search which works only on the first letter: if you press the 'T' key you will instantly jump to the first record whose index begins with T. It's a pity this principle couldn't have been extended to the succeeding letters so that you could home in on the required entry. When the bar cursor is over the entry you want, you can press RETURN to dial the number (supposing that you have an auto-dial modem connected, of course). Pressing SPACE opens a window which shows the full form for that record. When entering a new address you can choose any of the eight forms provided, and the Phonebook automatically keeps itself alphabetically sorted. If the forms do not hold enough information for you, you can Attach a Note to the entry, just like the ones in Outlook. The search facility permits searching through these notes, as well as the index entries and the forms.

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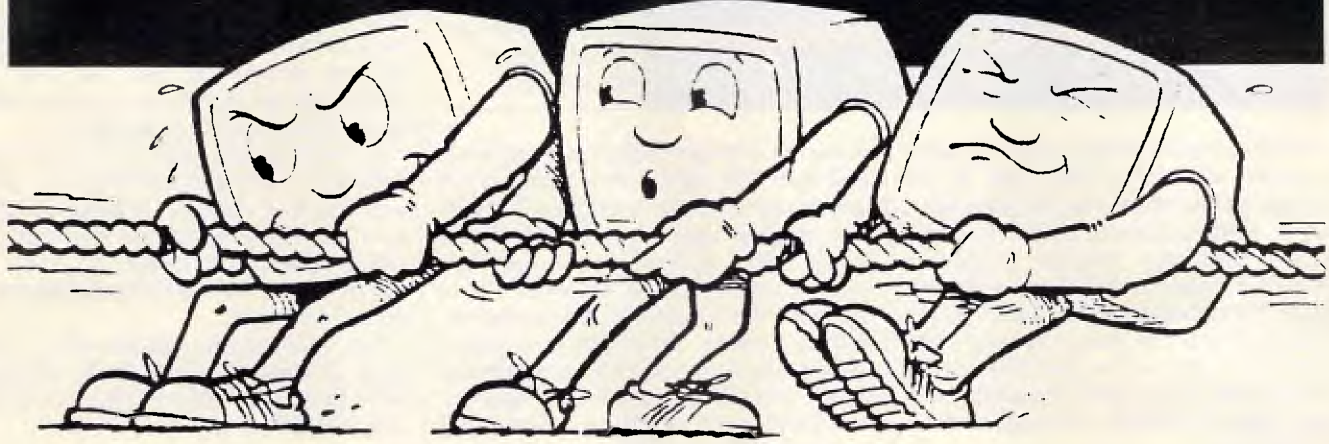

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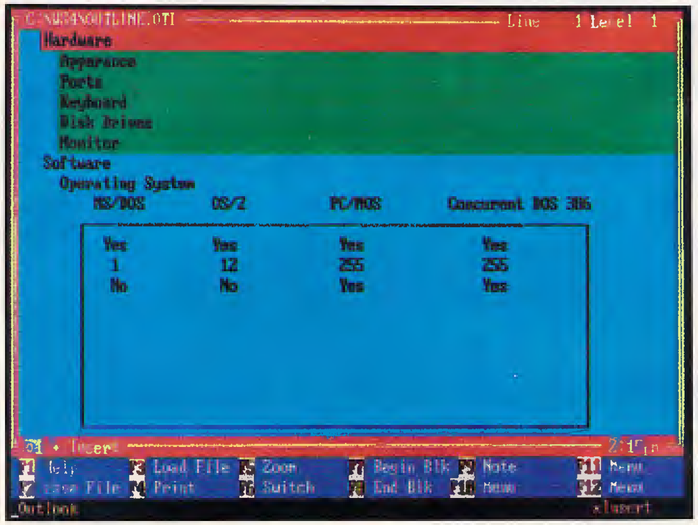

```
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Software
  Operating System
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     Yes           Yes         Yes           Yes
     1             12          255           255
     No            No          Yes           Yes
```

Outlook offers all the features you might expect from a dedicated outline processor. The diagram-drawing facility makes it extremely easy to draw tables and boxes in the manner shown here

Any Phonebook entry can be declared as being of Voice or Data type. If you declare it Data, then you can associate a set of communications parameters with it, and optionally a log-on script too. Though it's possible to keep as many different Phonebooks as you want, it is not essential; you can keep ordinary voice numbers and online services in the same book. A password protection system protects private information from prying eyes.

The script language is one of the best I have seen, with a clear Pascal-like syntax, and full looping and conditional branching. You edit scripts via a Notepad window just like a note, but on exit the editor checks the script syntax for you and places the cursor over the site of any error. If the thought of programming makes you blench, there is a learn mode which will write a script for you as you go through the log-on procedure manually. The background communications mode works, and I was able to download mail from BIX while writing this review in the foreground. Simply pop-up the Phonebook, dial the number with the download script attached, pop it down again; a hideous electronic burble, reminiscent of an arcade game phaser, is the only indication that the mail has arrived safely. I quickly came to love the Phonebook, which has even replaced the excellent ProComm in my affections.

Time planner

The Time Planner has advanced even further than the Phonebook. When you first select Time Planner from the main menu, a window which looks just like the old SideKick one-month Calendar appears, with today's date highlighted. Even this is improved, however; you can move the highlight using the cursor keys to a new date, rather than typing in the number as before. Pressing the 5 key on the keypad returns you instantly to today, which is handy when you are groping around finding out what day of the week the First World War ended on. Pressing the F5 'Zoom' key opens up a whole new ball game. A new window called the Schedule window appears which shows the next week, one day per line with a horizontal scale of hours.

> *'While ruminating on the reasons for SideKick's success, it came to me that in fact all it does is what the operating system ought to be doing . . . '*

Your appointments appear as horizontal bars, as on a wall chart, indicating their duration. You have the option of expanding this display to show the next two or four weeks at a glance. Moving the cursor to a day brings up the Appointment book for that day.

The Appointment book itself is hugely enhanced. You can choose the resolution, from hourly to five minute intervals, and the start and end of your day. You can designate days as holidays, which then appear as such in the Scheduler (weekends are already marked as holidays; some hope!).

Each Appointment still occupies only a single line, but you can have as much text as you want, automatically scrolling sideways.

However, for a lot of text you will probably prefer to attach a note (an Agenda) to the appointment, as in Outlook or the Phonebook. It's also possible to attach a note to the whole day, called the Daily Agenda, and this can be inspected directly from the Calendar or Schedule windows. The search facility allows you to string search through all the Appointments and Agendas, as well as for free periods of a specified duration, holidays included or not ("I can give you a 13 minute breakfast meeting on 1 March at 7.03am").

An interesting facet of the Appointments book is that it has been designed with networking in mind. In addition to your Personal book there is a Common Appointments book, password-protected so only authorised staff can alter it, which can be shared by a whole work group for scheduling meetings.

An alarm system allows you to set buzzers for a particular time/date, with pre-warning and 'snooze' facilities. It can also open the Phonebook and make a call at a certain time/date, or 'paste' a string into the underlying application at a certain time/date.

This latter facility enables you to run other programs automatically. All you have to do is paste suitable commands at the DOS prompt.

Calculator

The Calculator is no longer *one* but *four* calculators; you can switch the type to Business, Scientific, Programmer or Formula. All four types share the same screen image, which is rather less 'realistic' than of old since it lacks a keyboard. Instead, the calculator now has a 'paper tape', like a desk calculator, which records all the calculations performed, may be edited by using all the Notepad commands and can be stored as a named file. You can import a block of figures from the screen of another application onto the tape and then calculate then. All calculations are performed to 18-digit precision.

The options available in the four types of calculator are far too many to enumerate here. The Business calculator now has the percentage function notoriously lacking from the old SideKick, but also has a range of functions to do with interest and future payment calculations. The Scientific model has 18 trigonometric, log and other maths functions, and the Programmer has variable number bases and Boolean functions. All the calculators share the ability to use named variables in calculations, and the variables in use can be listed in their own window for inspection or editing; in the Scientific mode several universal constants such as pi, g, mu and h are

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Clipboard & ASCII chart

Though it doesn't feature by name on the main menu, the Clipboard deserves mention because the enhanced cut-and-paste functions are perhaps the most attractive feature of SK Plus. Where the old SideKick had a rag bag of import and export functions (for example, different commands to export from the Calculator and Notepad), SK Plus has a powerful, consistent ability to cut-and-paste from any application to another.

Cutting and pasting in underlying non-SideKick applications is performed by the CTRL-DELETE and CTRL-INSERT key combinations, and you can do this at any time without needing SK Plus to be on the screen. Pasting from any SideKick application to any other is performed by selecting the data (for example in the Notepad, as a block) and pressing ALT-ESC, which copies the date into the application or window which lies immediately below, at the cursor position. In applications which use structured data, an appropriate action is taken; in the case of the Phonebook a whole record is pasted; in the Scheduler the time and date is pasted, and so on.

> *'SideKick Plus is a very ambitious product indeed: it can no longer be considered a resident utility, but rather a whole operating environment . . .'*

All these cut-and-paste functions work via the Clipboard, which is a special Notepad window that you can inspect and edit, like that on the Macintosh. The currently active item (that is, the one which will be pasted) is always the first item in the clipboard and is highlighted, but previously cut-and-pasted items remain there in order, which is wonderful for accumulating clippings from various documents into a new document, for example.

SK Plus retains the priceless ASCII chart, but it too is now more powerful. It has a buffer in which you can assemble strings of non-typeable characters for pasting into documents (like an electronic Dymo label), and a clever system for enclosing or separating such strings with a chosen character. For example, if you are writing Pascal you could have all strings wrapped in single quotes, or they could be separated by commas.

User interface and customisation

Having sketched out *what* SideKick Plus does, now let's examine *how* it does it. You will probably have gathered by now that SK Plus has a great deal more functions than old SideKick. SideKick originally got by with a single-line menu at the foot of the screen, indicating the function key assignments. SK Plus needs two lines at the foot of the screen for function keys, together with a whole

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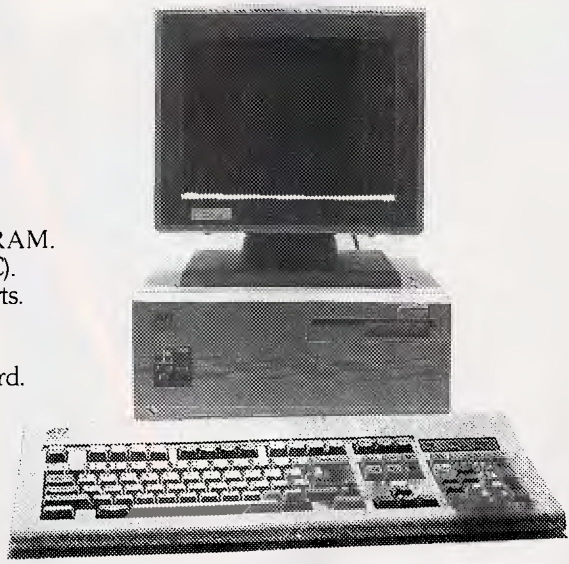

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system of GEM-style drop-down menus. The good news is that the system is well- designed and rapid to use, and what's more, if you don't like it you can change it.

Certain function keys are used consistently throughout SK Plus. F1 always provides context-sensitive Help. F5 is the Zoom key which instantly toggles a window between its default size and full screen. This feature has a huge effect on usability; it's quite practical to have eight or more small windows on the screen when you can expand the one you wish to work on at a single keystroke. F6 is the Switch key, which makes the next visible window active, in cyclic order. F7 and F8 in most applications are used to mark block beginning and end, and F10 summons up the drop-down menu system.

The drop-down menus actually resemble those on the Amiga Workbench more than GEM; when you select an option a new menu may drop down from that point, slightly offset to one side. The menu system is context-sensitive, so that only options which are currently available appear on the menu; for example, if no block is selected then the Block Move option doesn't appear. All menu choices can be made either by moving the bar cursor or by pressing the first letter of the option name, and as you become familiar with the location of things, you tend to use sequences of letters (cf. Lotus 1-2-3) without looking at the menus. Some of the menus go down to four levels deep, but this is only for default settings and other parameters, commonly used commands always being at the top level.

The menu system is fully customisable, a feature I have never encountered before. You can cut any menu option and paste it somewhere else in the menu path, perhaps at a different level. You can add new menu levels, or remove a level. You can assign any menu option to a function key or assign a keyboard 'shortcut' to any option.

Changes you make to the menu system can be saved permanently once you are happy with them. You can also alter the colours, size and position of any of the scores of windows, interactively, at any time, by pressing ALT-W to bring up the windows menu.

Setting up all the SK Plus windows to your satisfaction can be quite a task and can take a long time as, for example, each Notepad must be coloured separately. Once you have got it right you don't want to lose all that effort, and so the Services option on the main menu allows you to export the whole set-up as a file, which can be imported into any other SK Plus system.

System building & memory management

As I mentioned at the beginning of this piece, SideKick Plus is supplied as a set of modules and libraries on three disks. You need to copy all these to a hard disk, and then use the program called SKBUILD to link these modules into a system. SKBUILD is a menu-driven, interactive program and very simple to use. You pick those applications you wish to include from a menu, and set certain default memory sizes by sliding a bar with the cursor keys. You can choose how many Notepads and Outlooks (from 1-9) to include, though cutting down saves no memory. This is also where you tell SideKick about your modem.

> *'SK Plus has more functions than old SideKick . . . the good news is that the system is well-designed and rapid to use, and you can change it.'*

Borland intends to release the linkage specification to third-party software houses so they can write new applications that can be linked into SideKick Plus. You could have, for example, a spreadsheet or graph program on the main menu. How many will take up the offer remains to be seen, since the market is fragmenting at an alarming enough rate already, what with GEM, Windows and OS/2 to worry about.

Memory management in SK Plus is so sophisticated that it almost amounts to an alternative operating system. The program can be loaded in either swapping or fully-resident forms, and a number of permutations in-between.

The fully-resident mode is just like the old SideKick, all of the program being loaded into memory. A full system will take up about 256k in this mode, and all the applications will respond instantly.

In swapping mode only the kernel of SK Plus, which is 67k in size, is loaded into memory. This kernel controls two separate virtual memory systems, one for code and another for data. Every time you switch applications, the code will be read in from disk, and data will be continually swapped between memory buffers and disk. As you would expect, this mode slows the response time of SK Plus; on my slow PC it takes about three seconds to pop-up after you hit CTRL-ALT, and five second to pop down again, but on a fast AT clone it would be quite acceptable. The amount of main memory tied up is tiny (less in fact than old SideKick!) but a great deal of hard-disk space is used by the swap files, which can exceed 1Mbyte in size.

SK Plus can also use an Above Board (or equivalent) expanded memory card, or a RAM disk to hold its swap files, in which case the degradation of response time is negligible, and you get lots of free main memory. To use this option you must select it when originally building the system with SKBUILD.

You can even alter the memory strategy *after* SK Plus has been loaded. Running a program called SKBAT with a memory size as its parameter will reconfigure SK Plus, on the fly, to occupy that amount of memory. If you choose a figure between 67k and 256k then swapping will still occur, but less frequently and to a lesser extent. When building a system with SKBUILD you can also alter the various buffer sizes, and specify that a particular subset of the applications be made fully resident (that is, non- swapping).

Conclusion

I was initially worried that SideKick Plus would prove to be over-complicated. I was pleasantly surprised. After a few days of familiarisation it becomes as easy as the original SideKick, and the increased power of all the components is so welcome that I would find it impossible now to go back.

It's important to recognise that SK Plus is quite unusable without a hard disk and is not really much use without 640k of RAM, too. In these respects it is typical of the new generation of 'muscle' software.

As truly multi-tasking environments like DESQView, Windows/386 and OS/2 gain in popularity you may query the need for pop-up accessories like SideKick Plus at all. In my view, the individual applications in SideKick Plus are of such a standard that I would be hard put to better them with a collection of standalone applications, and the cut-and-paste facilities would be far less flexible in such a mixed bag.

I remain an addict.

END

SideKick Plus retails for $335 from Tech Pacific; tel: (03) 690 9055.

Stepping Out

Dreaming of a large screen display for your Mac? Cheer up. You already own the hardware you need. Stepping Out provides the rest, explains Salvatore Parascandolo.

Imagine working on a six-page MacDraw map of Australia, moving effortlessly through your work without once reducing or using a scroll bar. See yourself wielding full-page Excel spreadsheets and charts. Envision hoards of desk accessories neatly laid out on a 20 by 20in desktop. Imagine swiftly sailing through a PageMaker layout . . . tabloid . . . double-page . . . at 100 per cent . . . and imagine that you acquired this power for the price of a couple of video games. Science fiction? Stop imagining and go get it.

It's Stepping Out. It's software. It's the answer to the prayers of Mac owners who need a large screen display, but can't accommodate the bulk or expense of a large monitor.

Stepping Out converts your Mac's screen into a magic eye that you can move freely over your documents, as easily as panning a camera across a landscape. For graphics and layout projects, Stepping Out's instant edge-sensitive scrolling lets you devote more time to *creating* your work rather than hopping around it. You can practically wave goodbye to those jumpy little scroll bars and Fit in Window views.

Step this way

In the Mac universe, applications interface with us through windows of various sizes and properties. Most well-written applications, especially those of recent vintage, can use windows which are far larger than the Mac's screen. Normally, they sense that your screen is only 512 X 342 pixels, and they'll display just enough information to fill it. When you need to see other parts of your documents, you use the familiar scroll bars that tell your application to calculate and present a new view. This computed scrolling can be rather slow.

Stepping Out convinces every application that your screen has grown to, say, 612 X 792 pixels (8.5ins X 11ins). It then reserves an area of memory large enough for such a screen which applications amenably fill with their output. You can still view only a portion of this large space, but to see a hidden area you just slide your mouse in its direction and Stepping Out instantly transfers the proper contents of the *virtual* screen to your *physical* screen. The faster you mouse, the more space you traverse. Its speed and smoothness are sheer ecstasy. I've shown it to both Mac and PC lovers, and it's never failed to leave their jaws hanging.

> *'Suddenly you are unable to manipulate objects . . . you hear beeps regardless of where you click or what you press.'*

Some applications don't allow you to enlarge their windows. You can still use the extra desktop space created by Stepping Out to lay out desk accessories without overlapping them, creating a more natural desktop arrangement than stacking and shuffling your telephone book, calculator, note pad, Scrapbook and what have you.

It naturally follows

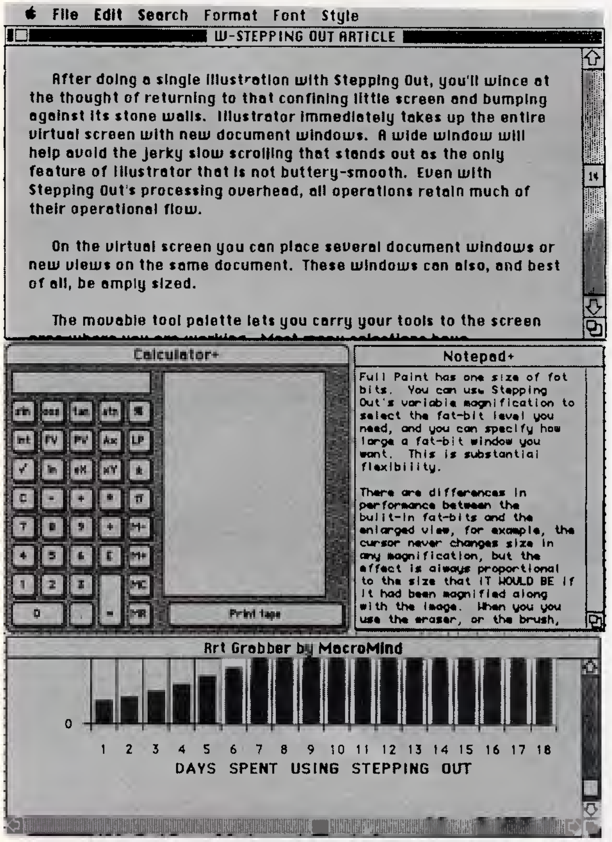
Stepping Out's basic talent is its ability to follow the cursor as it leaves the visible screen. This minor miracle adds auto-scrolling capabilities to applications which lack it, like MacDraw, and it easily outperforms the built-in auto-scrolling of applications like MacDraft, Cricket Draw, SuperPaint and Illustrator.

Stepping Out exhibits a similar talent during text entry. It instantly follows the text insertion pointer (I-beam) as it attempts to leave your view. You can thus use extra wide text windows and always see what you're typing. When words wrap around, your view zips back to the left margin of the document. This function is independent of the application you're actually using and it's superior to the lateral scrolling provided by some word processors. It's a handy feature if you must compose wide text in true WYSIWYG mode, but I find that the normal 512-pixel window is best, because I can see entire paragraphs without scanning laterally.

If you plan, paint, illustrate, design forms, draw, draft or publish, you need Stepping Out. If you write, program, chart, spreadsheet and rely on desk accessories, it'll give your productivity a healthy boost. (If you mostly play video games, or are thrilled by watching a screen-saver in action, save your cash.)

Step one

You install Stepping Out by copying it onto any disk. It occupies a modest 18k of space. Thereafter, you simply double-click its icon from the Finder. The first time you activate Stepping Out, it



After doing a single illustration with Stepping Out, you'll wince at the thought of returning to that confining little screen and bumping against its stone walls. Illustrator immediately takes up the entire virtual screen with new document windows. A wide window will help avoid the jerky slow scrolling that stands out as the only feature of Illustrator that is not buttery-smooth. Even with Stepping Out's processing overhead, all operations retain much of their operational flow.

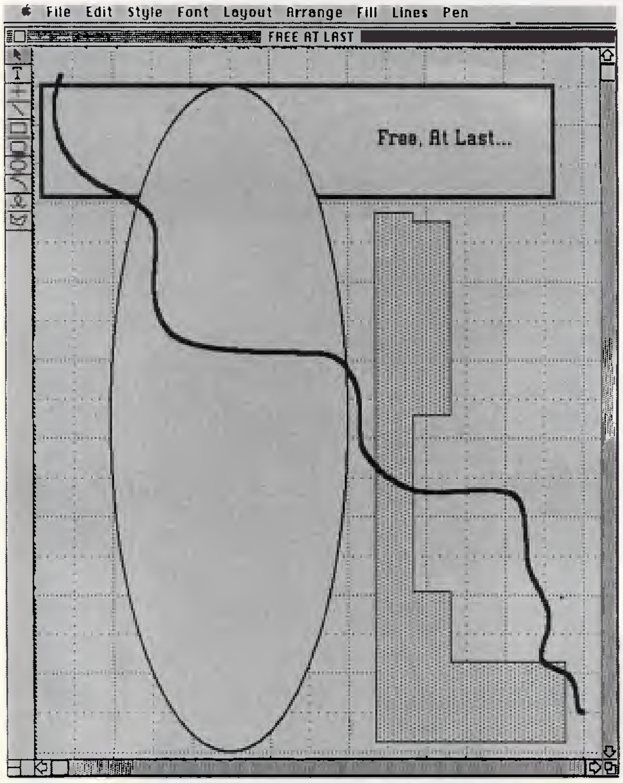
On the virtual screen you can place several document windows or new views on the same document. These windows can also, and best of all, be amply sized.

The movable tool palette lets you carry your tools to the screen

Full Paint has one size of fat bits. You can use Stepping Out's variable magnification to select the fat-bit level you need, and you can specify how large a fat-bit window you want. This is substantial flexibility.

There are differences in performance between the bulit-in fat-bits and the enlarged view, for example, the cursor never changes size in any magnification, but the effect is always proportional to the size that IT WOULD BE if it had been magnified along with the image. When you you use the eraser, or the brush,

You no longer need to keep your desk accessories in a jumbled heap. Take advantage of available screen space for tool and reference windows. You save shuffling time and can still see the information displayed in inactive windows



Freehand drawing truly flows in any application that supports full-page windows. In this drawing, all the objects were rendered in normal size in a few seconds, without regard to anything but the creation process

automatically begins to create a virtual screen with the pixel dimensions you last chose. You can halt the automatic process by holding down the mouse button and specifying a new width and height. If you activate Stepping Out with a virtual screen already in use, it will wait for you to enter a new size. Stepping Out also tells you how much RAM is needed for the screen you specify. It's that quick and easy to resize or remove the virtual screen for each application you use.

The basics

You'll need a 512k Mac or better. Stepping Out uses about 84k of basic operating RAM, plus 648 bytes for each square inch of virtual screen, or 60k per 8.5 X 11in page. This roughly translates to 141k for the equivalent of a Radius Full Page Display.

With a Mac 512k, you can free up RAM by reducing or turning off your RAM cache and/or RAMdisk. On a Mac with a megabyte or more, you must still pay attention to the screen memory size if you use a large cache, RAMdisk or Switcher. With two or more megabytes you can practically forget calorie-counting. Experiment to arrive at the set-up that suits your hardware, software, working style and project. Take care, however: some applications and desk accessories may just hang, or crash when they run short of memory.

The few rare times I've crashed the System, I've found the greedy culprit at the keyboard, trying to squeeze too much into too little. Stepping Out is fundamentally bomb-proof. It has to be. I've routinely used it with a RAMdisk, RAM cache on, Switcher, desk accessories and an interactive spell-checker all chugging away. It remains flawlessly active between applications, even if control switches to a System on a different disk.

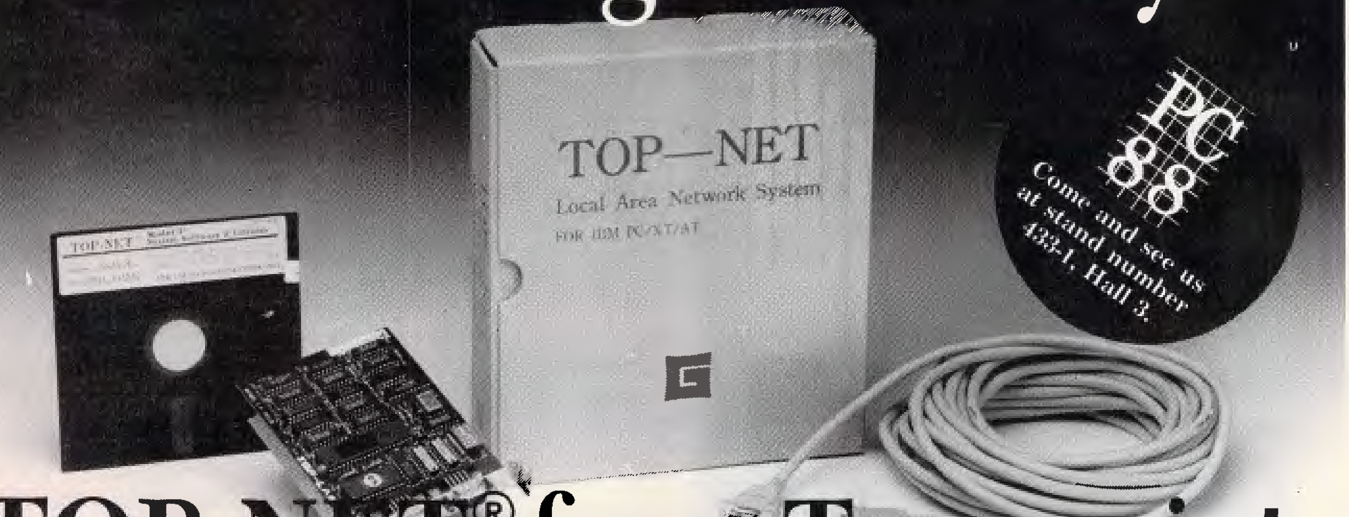
It lends a lens

As if a large virtual screen were not enough, Stepping Out puts sixteen levels of split-screen magnification at your disposal using COMMAND-OPTION-2 through 16 — instant functional Fat Bits any time. Use this tool to make fine adjustments to technical drawings, scanned images or page layouts. If your eyesight needs a boost, you have a built-in set of spectacles. You can resize the portion of the Mac screen devoted to magnified view, from one-inch wide up to a full screen, by using COMMAND-OPTION-R and mousing left or right.

Seeing a shrink

Berkeley System Design hasn't forgotten that you'll occasionally need a bird's-eye view of your large screen. With COMMAND-OPTION-SPACEBAR, you'll get a split-screen Reduce to Fit view where the left side of the screen displays a normal-size section of the area around the cursor, and the right side shows most or all of the virtual screen, highly reduced. Two levels of reduction are available.

Three cost saving ways to networking flexibility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Total Length:	1000m	6500m	2500m for Ethernet coaxial 900m for RG58/U cable
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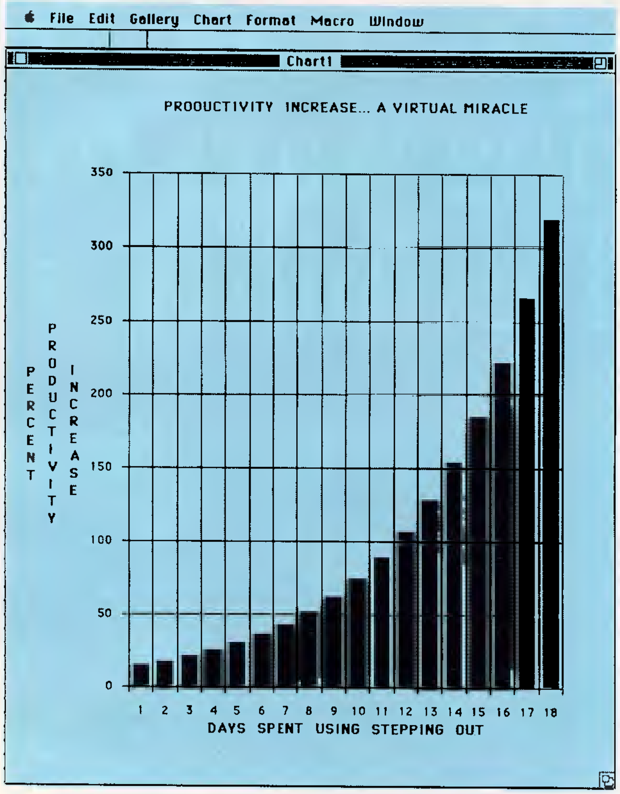
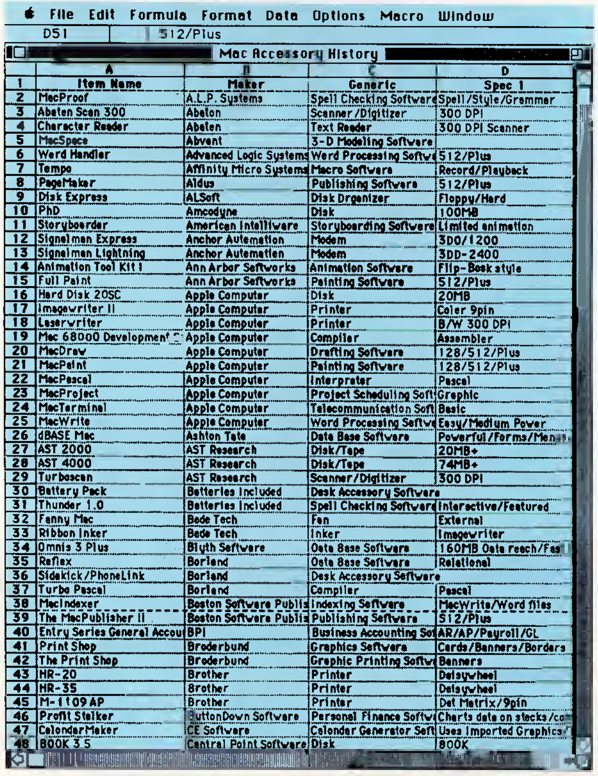


Excel's charts can grow in stature in the freedom of large screens



	A	B	C	D
1	Item Name	Maker	Generic	Spec 1
2	MacProof	A.L.P. Systems	Spell Checking Software	Spell/Style/Grammar
3	Abaton Scan 300	Abaton	Scanner/Digitizer	300 DPI
4	Character Reader	Abaton	Text Reader	300 DPI Scanner
5	MacSpace	Abvent	3-D Modeling Software	
6	Word Handler	Advanced Logic Systems	Word Processing Softwa	512/Plus
7	Tempo	Affinity Micro Systems	Macro Software	Record/Playback
8	PageMaker	Aldus	Publishing Software	512/Plus
9	Disk Express	ALSoft	Disk Organizer	Floppy/Hard
10	PhD	Amcodyne	Disk	100MB
11	Storyboarder	American Intelliware	Storyboarding Software	Limited animation
12	Signalman Express	Anchor Automation	Modem	300/1200
13	Signalman Lightning	Anchor Automation	Modem	300-2400
14	Animation Tool Kit I	Ann Arbor Softworks	Animation Software	Flip-Book style
15	Full Paint	Ann Arbor Softworks	Painting Software	512/Plus
16	Hard Disk 20SC	Apple Computer	Disk	20MB
17	Imagewriter II	Apple Computer	Printer	Color 9pin
18	Laserwriter	Apple Computer	Printer	B/W 300 DPI
19	Mac 68000 Development	Apple Computer	Compiler	Assembler
20	MacDraw	Apple Computer	Drafting Software	128/512/Plus
21	MacPaint	Apple Computer	Painting Software	128/512/Plus
22	MacPascal	Apple Computer	Interpreter	Pascal
23	MacProject	Apple Computer	Project Scheduling Soft	Graphic
24	MacTerminal	Apple Computer	Telecommunication Soft	Basic
25	MacWrite	Apple Computer	Word Processing Softwa	Easy/Medium Power
26	dBASE Mac	Ashton Tate	Data Base Software	Powerful/Forms/Men
27	AST 2000	AST Research	Disk/Tape	20MB+
28	AST 4000	AST Research	Disk/Tape	74MB+
29	Turboscan	AST Research	Scanner/Digitizer	300 DPI
30	Battery Pack	Batteries Included	Desk Accessory Software	
31	Thunder 1.0	Batteries Included	Spell Checking Software	Interactive/Featured
32	Fanny Mac	Bede Tech	Fan	External
33	Ribbon Inker	Bede Tech	Inker	Imagewriter
34	Omnis 3 Plus	Blyth Software	Data Base Software	160MB Data reach/Fas
35	Reflex	Borland	Data Base Software	Relational
36	Sidekick/PhoneLink	Borland	Desk Accessory Software	
37	Turbo Pascal	Borland	Compiler	Pascal
38	MacIndexer	Boston Software Publis	Indexing Software	MacWrite/Word files
39	The MacPublisher II	Boston Software Publis	Publishing Software	512/Plus
40	Entry Series General Accou	BPI	Business Accounting Sof	AR/AP/Payroll/GL
41	Print Shop	Broderbund	Graphics Software	Cards/Banners/Borders
42	The Print Shop	Broderbund	Graphic Printing Softwa	Banners
43	HR-20	Brother	Printer	Daisywheel
44	HR-35	Brother	Printer	Daisywheel
45	M-1109 AP	Brother	Printer	Dot Matrix/9pin
46	Profit Stalker	ButtonDown Software	Personal Finance Softwa	Charts data on stocks/co
47	CalendarMaker	CE Software	Calendar Generator Soft	Uses Imported Graphics
48	BOOK 3.5	Central Point Software	Disk	800K

A wide view is great for entering data, and even better for using you data. In this Excel window, every click in the vertical scroll bar jumps you 48 rows. Selecting cells is faster, since more cells are visible in the larger window

Voilà, a *working* page preview mode for most of your applications. In both enlarged and reduced views, all your applications' tools are fully functional.

This may come as a shock to you, but your Mac shows you things in reverse video; black dots on a white background. 'Normal' video is white on black. If you long for the world of normal video Stepping Out lets you invert the display using OPTION-COMMAND-B. This will give you a blueprint-like preview of your drafting work. I found it eye-soothing to periodically invert the display during word processing. Inverted Chicago font is rich and readable.

Mr Big Shot

A screen shot is an exact 512 X 342 pixel screen dump in MacPaint file format, titled 'Screen 0', then 'Screen 1' and so on. *APC* Mac articles are profusely illustrated with them. Ordinarily, you would dump the screen by typing COMMAND-SHIFT-3. With Stepping Out, COMMAND-OPTIONS-S produces a 576 X 720 pixel (8 X 10in) MacPaint file. These images never include reduced, enlarged or inverted views regardless of what's on the physical Mac screen. Most illustrations for this article were produced this way.

Although it works with Switcher, Stepping Out simply refuses to be launched by Switcher, so always launch Stepping Out first. Define a screen size that best fits your mix of applications. A size/shape that's optimal for one program may be inefficient for another. For example, a 640-pixel wide screen is fine for graphics, but may be frustrating for word processing because you'll usually overshoot the vertical scroll bar, and you'll rocket sideways instead. Place text windows flush with the far right edge of a wide screen so you can't overshoot their vertical scroll bars.

As you set up each switchable application, be sure to clear the Save Screen checkbox in the configuration dialog (or click its Macintosh icon in the Switcher window). Each application will then redraw its screen each time you switch to it. Otherwise, whenever you go from application A to application B, B's window may *appear* to contain the bottom part of A's window. This effect varies with the mix of applications, it's harmless and strictly cosmetic, but it leaves an unworkable mess.

May I see the menu?

As you race across or down your large virtual screen, the menu bar, palettes and other non-trivial items unabashedly scroll away. Ordinarily, these don't move when you use scroll bars, but Stepping Out moves everything. Stepping Out 2.0, to be available shortly after you read this, promises to keep the menu bar and tool palettes in view at all times. Meanwhile, you can reduce the inconvenience by using Command-key equivalents for menu selections. If an application lacks such equivalents, you can usually assign them via CE Software's QuicKeys or the careful use of ResEdit. Where possible, strategically relocate any movable tool palettes provided by applications such as PageMaker, Ready, Set, Go!, Illustrator, ComicWorks, SuperPaint and FullPaint.

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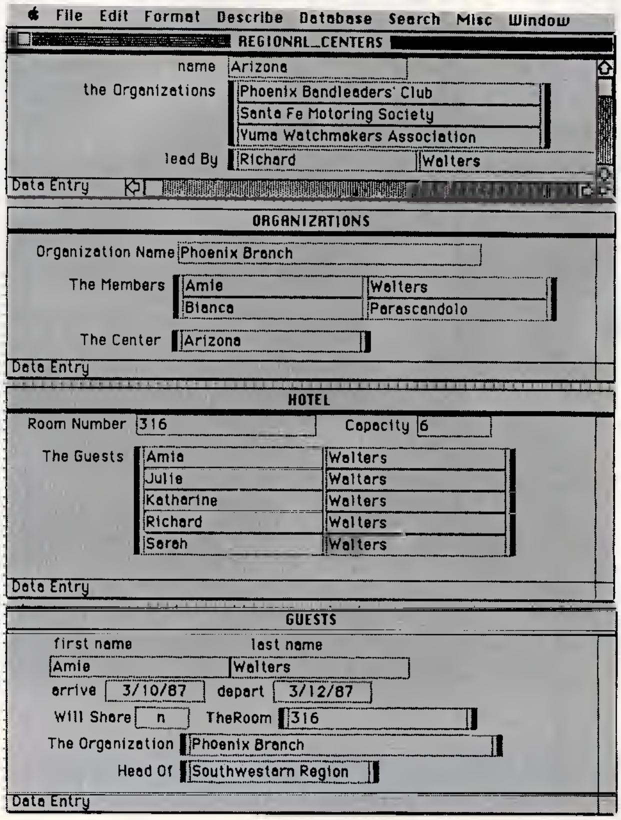

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the Organizations: Phoenix Bandleaders' Club; Santa Fe Motoring Society; Yuma Watchmakers Association
lead By: Richard Walters
Data Entry

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The Center: Arizona
Data Entry

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Capacity: 6

The Guests	
Amie	Walters
Julie	Walters
Katharine	Walters
Richard	Walters
Sarah	Walters

Data Entry

GUESTS

first name: Amie
last name: Walters
arrive: 3/10/87
depart: 3/12/87
Will Share: n
TheRoom: 316
The Organization: Phoenix Branch
Head Of: Southwestern Region
Data Entry

Don't overlap — distribute. With many related Reflex database windows fully visible, you can save hunting and redrawing time, and you'll get a better overall picture of your data

On the alert

Sooner or later this will come to pass: you've commanded Stepping Out to set up a large screen, and are working away. Suddenly you are unable to manipulate objects, or your text insertion pointer disappears, scroll bars turn white or you hear beeps regardless of where you click or what you press. Your application is probably trying to tell you something. Somewhere in that sea of pixels, there is an out-of-view dialog box waiting for a response. Take a quick mouse-jog around the screen. If you're really baffled, examine your desktop in a reduced view. With experience, you'll know where each application puts its dialog boxes.

Stepping in Tempo

Stepping Out works well with Tempo, a desk accessory for creating macros, provided you activate Stepping Out first. Be aware that Stepping Out uses COMMAND-OPTION-SPACEBAR, -B,-R, -S,-X, and -2 up to -16 for its functions so you may need to reassign some of your Tempo keys to prevent interference.

Tempo macros can help save time by auto-travelling to distant menus and palettes. When a macro runs, however, Stepping Out follows the cursor on its programmed journey and you must then mouse back from whence you came. At least it's a one-way trip.

Generally with Stepping Out activated you can record and faithfully play back macros. You can wander all over your big screen, and be assured that Tempo will reliably and quickly retrace your steps. Excel macros also record and replay perfectly.

However, the combination of Stepping Out, MacDraw and Tempo seems to add 'do-nothing' steps to macros during the recording process. These padded macros play back about eight times slower than normal, with or without Stepping Out active. If you record your MacDraw macros before activating Stepping Out, they'll play back well.

The overhead of oversize

The advantages of Stepping Out may cost you a modest amount of speed during processing-intensive operations. For example, both Thunder's and MacLightning's batch spell-checking modes run about 25 per cent slower, as does Excel's sorting and macro playback. With object-oriented graphics applications, you must use freehand tools more slowly, or your paths may turn out more angular than curved.

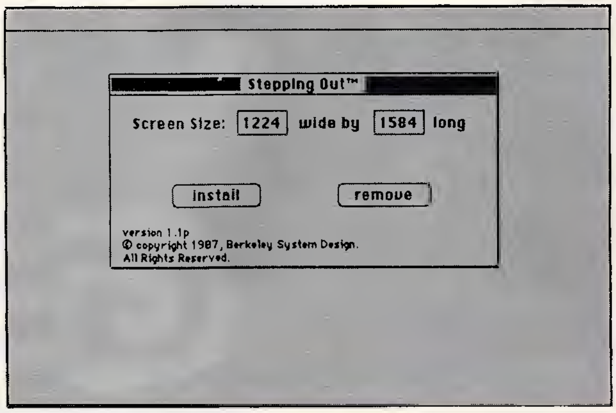
Stepping Out Version 1.1p is more transparent, and needs substantially less overhead than the earlier 1.05 version. Overall, for graphics and layouts, the adaptive steps are quite bearable, and the speed loss is insignificant compared to the time you save and the freedom you gain.

I used Stepping Out with Finder versions 5.3, 5.4 and 5.5 with no problems. With wide virtual screens you can't see the disk or trash icons unless you mouse over to the extreme right, which moves you out from under the handy Finder menus. Dragging the disk icons into view is only a temporary solution. After you quit an application, the disk and trash icons always reappear at their far-right abodes.

Moral: don't bother with disk icons. Instead, double-click each disk and drag its opened window into view somewhere under the menus. Leave your often-used windows open even when you eject or trash their disks. Whenever you reinsert a disk, its window(s) will reappear, opened and in view. Similarly, you can drag single applications or documents into view before ejecting their disk(s). Sorry, I found no work-around for the self-motivated trash can.

Do you copy?

When you drag icons from disk to disk for copying, you may see the icons disappear from the original disk, and the normal file copy dialog may not appear when you expect it. And most animation effects — like folders zooming in and out when you click to open or close them — are suspended in Stepping Out. Don't



Screen Size: 1224 wide by 1584 long

version 1.1p
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The one and only Stepping Out dialog box is where you specify your screen size in pixels. The amount of RAM needed for a screen of the specified size is instantly calculated and shown in the lower right corner

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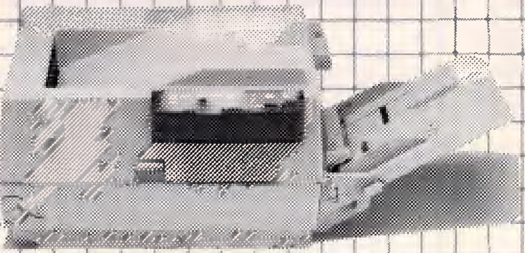

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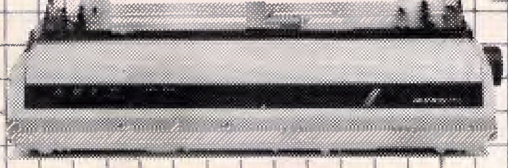

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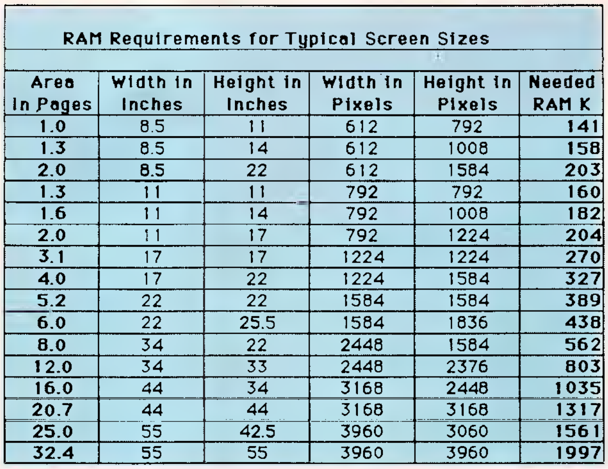
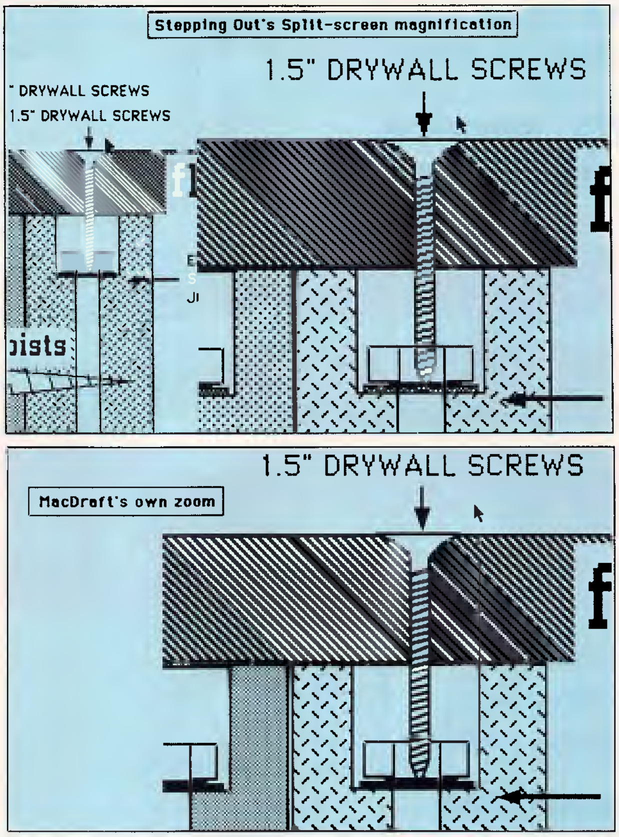


RAM Requirements for Typical Screen Sizes

Area in Pages	Width in Inches	Height in Inches	Width in Pixels	Height in Pixels	Needed RAM K
1.0	8.5	11	612	792	141
1.3	8.5	14	612	1008	158
2.0	8.5	22	612	1584	203
1.3	11	11	792	792	160
1.6	11	14	792	1008	182
2.0	11	17	792	1224	204
3.1	17	17	1224	1224	270
4.0	17	22	1224	1584	327
5.2	22	22	1584	1584	389
6.0	22	25.5	1584	1836	438
8.0	34	22	2448	1584	562
12.0	34	33	2448	2376	803
16.0	44	34	3168	2448	1035
20.7	44	44	3168	3168	1317
25.0	55	42.5	3960	3060	1561
32.4	55	55	3960	3960	1997

These are very close approximations of the extra RAM you'll need to set up various sizes of virtual screens. Be careful not to stress the limits of your RAM, or some programs may hang or crash without warning



Stepping Out's variable split-screen magnification provides FatBits anytime. This 2X magnification of a MacDraft image (top) shows the extra jaggies you get with Stepping Out, compared with MacDraft's own zoom function (bottom). Still, it's a passable view, and switching from normal to enlarged view is instantaneous

worry. It's all cosmetic. The Mac is too busy copying to let Stepping Out display an up-to-the milli-second view.

On an SE, Stepping Out responds slightly faster than on a Mac Plus. And, although Stepping Out version 1.1p doesn't work on a Macintosh II, version 2.0 should.

I tested Stepping Out on a Mac Plus adapted for a Radius Full Page Display. Although I could define a large screen, there was no auto-scroll response when I moused past the visible screen's edges. In their present incarnations, there is nothing to gain by using, or even owning Stepping Out if your Mac has been adapted for a full page display. Future versions of each may change that.

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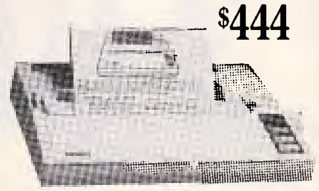

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Word 3.01

Microsoft applied industrial strength bug spray and tossed in a dash of PC flavour for the latest — but surely not the last — Mac Word.

Let's get the big question out of the way first: version 3.01 of Microsoft Word works.

As a matter of fact, the new version — the number indicates a slight revision to the original, but it's a lot more — works quite well. It's good that it does, or Bill Gates would have found mobs of Macintosh users, lit tapers in hand, camped beneath his office window, howling for blood. It would not have been a pretty sight.

Word is important for the same reason that the new Apple keyboards are important; there's not much choice if you're a serious writer. I keep hearing about people who've written tomes using MacWrite and the original Macintosh keyboard, but they always struck me as the kind of people who dug through mountain ranges with a ballpoint pen. They presumably did it that way because they had to, but would have done it an easier way if one had been available.

Word 3.01 is that way. It's good, and it's powerful and its use is reasonably intuitive. At this writing — and there are other power word processors due on the market any minute — Word 3.01 is about all there is in its class.

Many, but not all, of the differences between versions 3.0 and 3.01 are bug fixes. Most of the others are changes in printing, and only one is of real consequence for a large number of users. To be sure that a document created under version 3.0 will print in 3.01, Microsoft tells you to open the document, repaginate while holding down the Shift key and immediately save. Some of the other changes may affect you, so be sure to check out the Read Me First document on the disks.

Some annoying quirks remain. Snaking, newspaper-style columns still don't appear on screen next to each other, though you can see how they'll finish up in a document preview window. And there *still* isn't a way to count words. So, editors, if this review runs over or under, my apologies — Word just didn't let me check to see if it was to length.

In talking to other users while writing this review, I discovered a surprisingly strong love for MacWrite — a love that certainly exceeds its usefulness. Word is 'too complicated,' people said; 'too many keystrokes — I don't need all that stuff.'

> *'Word is important for the same reason that the new Apple keyboards are important; there's not much choice if you're a serious writer.'*

That may be true. Word is a lot of program, and if all you do is punch out an occasional letter or memo that you don't mind printing in 12-point Helvetica, Word probably isn't for you. If you write long reports, need to import graphics or could benefit from customisable pull-down menus, check out Word.

Some people, though, crave simplicity. For them, Word features a Short Menus mode, accessible at the bottom of the Edit menu. For example, in Short Menus the Document menu gives you a choice of opening a header or a footer, repaginating, inserting a footnote and checking the spelling. With Full Menus, you can also use a built-in outliner, generate an index and table of contents, perform calculations and number paragraphs. We'll go back to the flexibility of the menus later. For the moment, let's look at how the program is organised.

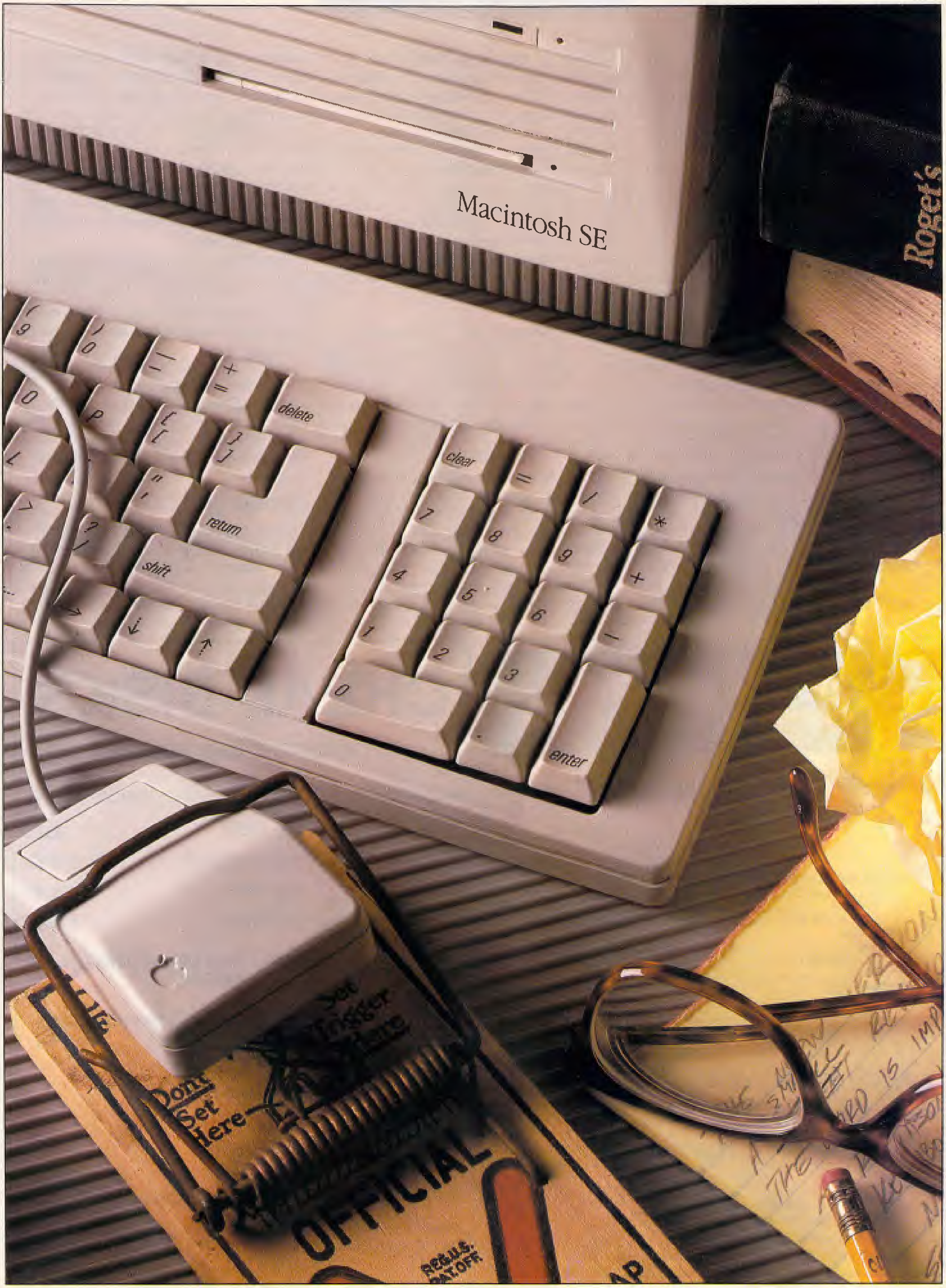
Mouseless machinations

IBM PC users will be right at home with Word. In fact, it is possible to work with the program and barely touch the mouse. Pressing the period on the numeric keypad puts the menu bar in reverse video for a few seconds. While it's in reverse, pressing a number on the keypad from 0 to 7 pulls down the corresponding menu: 0 brings down the Apple menu, 1 the File menu, 2 the Edit menu and so on. Pressing either the down cursor key or the 2 on the numeric keypad (which corresponds to a down key on a PC keypad) moves you down the menu.

You don't even need the mouse to select text. Holding down the shift key while pressing a cursor key or a numeric keypad key will select text in that direction. SHIFT-2 will highlight text down; SHIFT-8 highlights it up; SHIFT-4 highlights left; and SHIFT-6 highlights right. SHIFT-7 moves the cursor to the beginning of the line and SHIFT-1 moves the cursor to the end of the line.

Carrying the IBM analogy further, the Command key works like the PC's Control key, so pressing COMMAND-6 moves the cursor to the next word to the right, and so on. The exception is COMMAND-1, which moves not to the end of the line, but to the end of the current sentence. Pressing COMMAND-SHIFT-6, then, would highlight the word to the right.

Wait — it gets better. All 26 letters of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the alphabet have Command-key combinations assigned to them, and some of them are pretty obscure. A spelling check is started by pressing COMMAND-L. Footnoting is COMMAND-E. Character formatting is COMMAND-W.

Some of the most vital key combinations aren't even shown on the screen. You'd have to look in the manual to see that COMMAND-SHIFT-B boldfaces text, and COMMAND-SHIFT-I italicises it. And you have to be pretty sharp-eyed to find out that COMMAND-SHIFT-> increases the size of the selected text, and that COMMAND-SHIFT-< decreases it.

If you're not a keyboard freak, mousing around with Word is pretty straightforward. When the pointer is in the extreme left edge of the window, it points upwards and to the right — sort of north by northeast. Single-clicking marks the line next to the pointer; double-clicking marks that whole paragraph. Command-click marks the entire document; that turns out to be a fairly important technique, as you'll see later.

If you want to use the ruler, though, you'll have to use the mouse. The two triangles beneath the 0 on the ruler line control the left margin. You adjust the margin by clicking and dragging them. Clicking on the upper triangie lets you adjust the size of a paragraph's first-line indent. Clicking and dragging the lower triangle moves the left margin and keeps the indent distance fixed relative to the margin. If you want to change the margin and leave the indent where it is (that is, fixed relative to the ruler), Shift-Click and drag on the lower triangle. The vertical lines on the ruler itself mark default tab stops, and the triangle on the right marks the right margin. The right margin can be dragged; default tabs need to be set from the Page Setup entry on the File menu.

The material on the line beneath the ruler line is fairly self-explanatory. The four characters on the left represent left, centre, right and decimal tabs. The vertical line places a vertical line in your document. The four alignment icons set a paragraph to be left-aligned, centred, right-aligned or justified. The icons to the right of them control single-spacing, line-and-a-half spacing or double-spacing. The rightmost set lets you put an extra line space before a paragraph.

The key to all the formatting commands which can be issued through the ruler line is that they affect *only the paragraph that contains the cursor or is currently highlighted*. This goes to the heart of what some people consider to be Word's confusing user interface. If you change margins or fonts, only the current paragraph's margins or fonts will be changed, unless you've marked more than one paragraph. To affect the entire document, you must put the pointer on the left edge of the window, press COMMAND-CLICK, and only then make the change you want.

Remember: Word formats its documents on a paragraph-by-paragraph basis. It's not enough to make a change — you must make sure that the change is applied to all the paragraphs you want changed.

So you see the designers have taken great pains to keep both Mac and PC users reasonably comfortable with Word. Comfort, though, means nothing if the program doesn't work or doesn't have the features that make the thing useful.

Ulterior bugs

Version 3.0 was excoriated for its bugs, but if 3.01 has any left, I couldn't find them. When I asked other users exactly what the problems were with version 3.0, they told me that its display and printing

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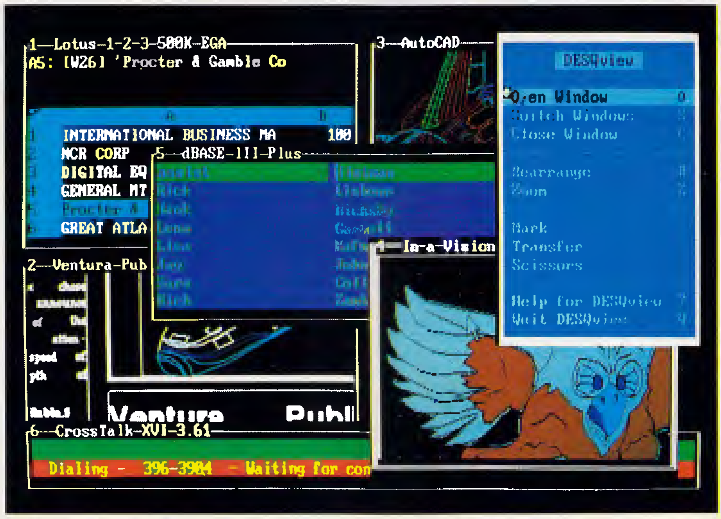

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PC MAGAZINE EDITOR'S CHOICE NOV. 24, 1987

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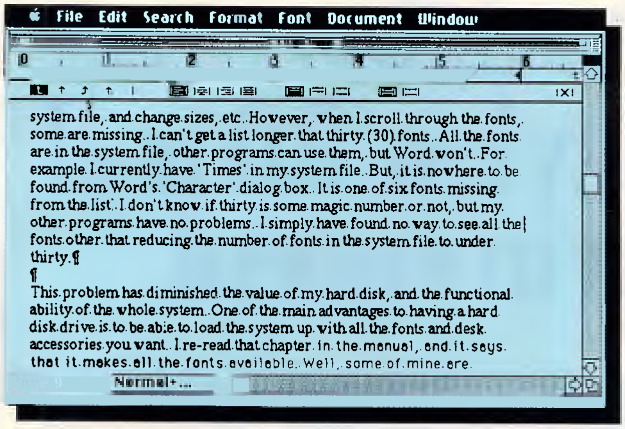

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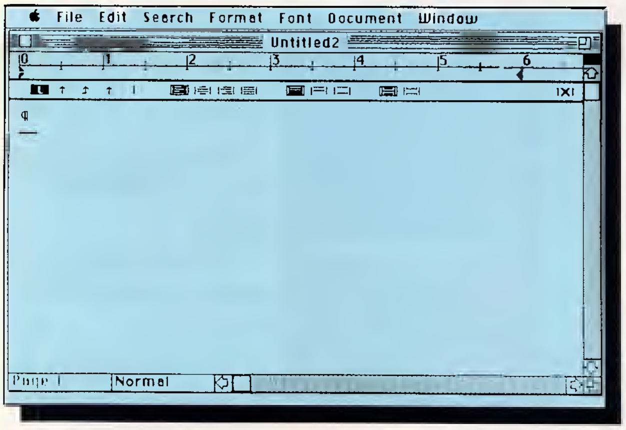
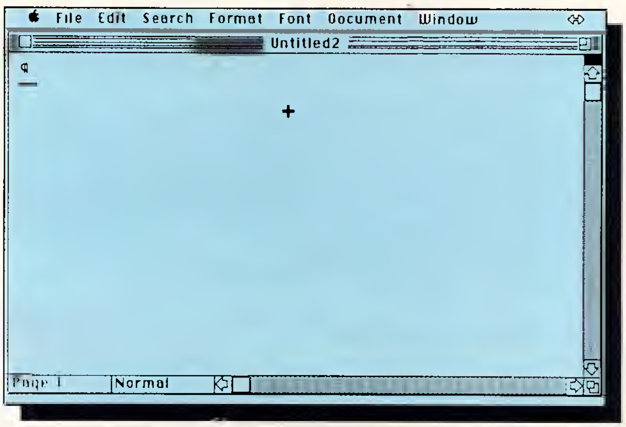
The menu bar goes into reverse mode when you press the period on the keypad. This allows you to access all of the menu commands using the keypad numbers and cursor arrows



To resize margins and indents, click the mouse and drag the two triangles beneath the 0 on the ruler. The vertical lines on the ruler indicate the default tabs, and the large triangle beneath the numeral 6 marks the right margin for the document



Pressing COMMAND-OPTION-+ turns the cursor into a giant plus sign. This forces Word 3.01 to recognise all the fonts in your System, including the ones it previously ignored

'didn't work.' (Actually, I was told it in rather stronger terms not suitable for a family magazine.) Specifically, the old version had a habit of depositing paragraphs unexpectedly and randomly across the printed and displayed page.

Statements like this tend to follow writers into their graves, but I could find no functional problems with Word 3.01. Everything worked, if not precisely instinctively, at least reasonably well.

Now, with everyone gunning for this release of Word, I fully expect the letters column to be full of complaints like, 'Rosenbaum's obviously on the turps; features A, B and C don't work right.' But remember — just because something doesn't work the way you think it should doesn't mean it doesn't work.

And in fact, not everything here is wonderful; there are some oddities in the way Word works. The program doesn't pick up all the fonts in your System, and it doesn't automatically remember your preferred working font. The manual fails to explain the former, but tells how to fix the latter.

To fix the default fonts, you have to mess with style sheets. Style sheets are Word's way of controlling prefab paragraph formats. If you want a paragraph to be double-spaced with a 1.5in left indent, you can define a 'style' which you may then apply to whatever paragraphs you wish to carry that format. Every paragraph has a 'style,' but the default style is called 'Normal.' (The style for the current paragraph is shown at the bottom of the screen, next to the page number.) To set your default font, you need to edit the Normal style so it includes the font you want.

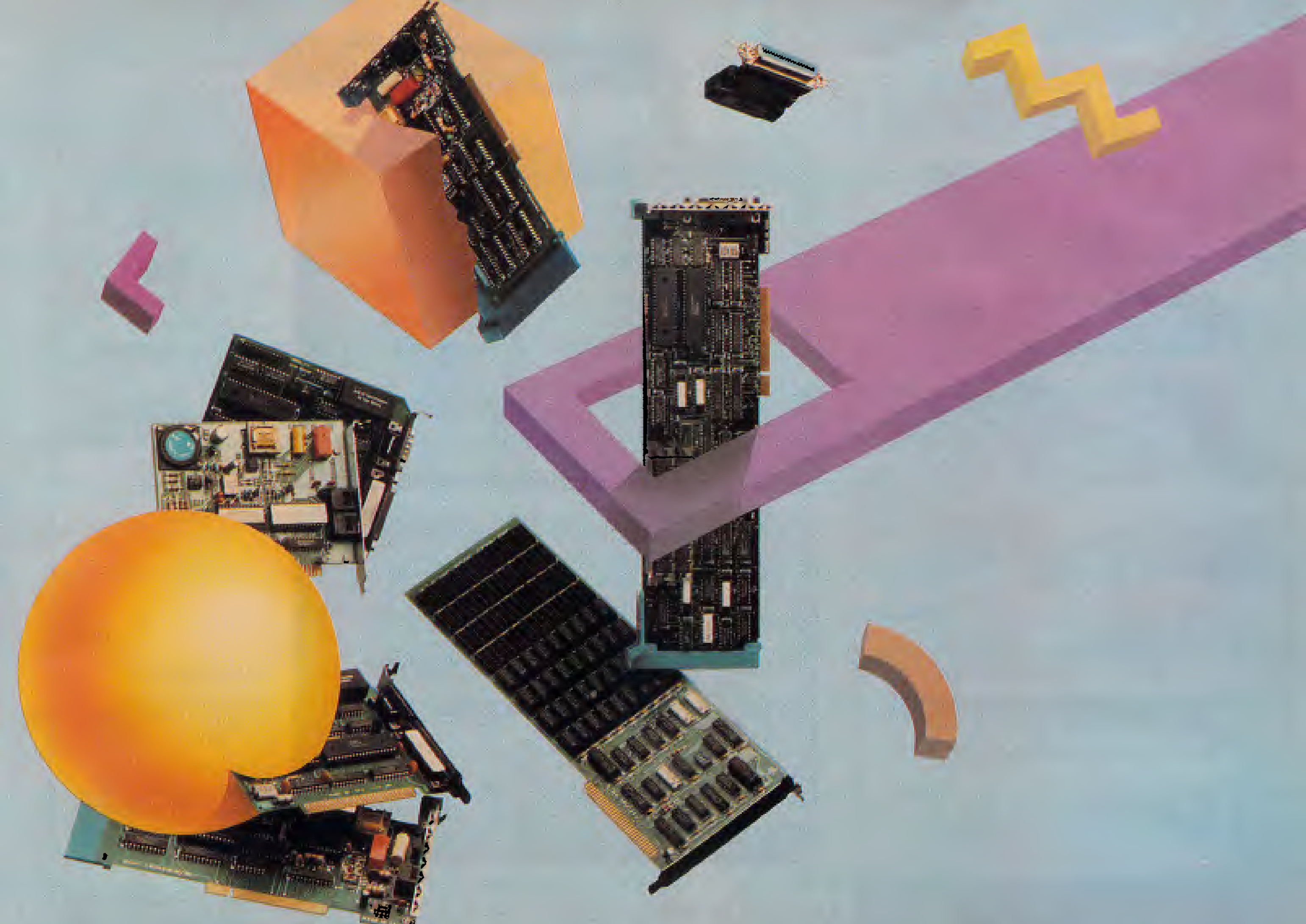
Edit a style by pressing COMMAND-T (or select DEFINE STYLES on the Format menu), clicking on Normal and formatting as usual. If you want to set the font, use the Font menu. Then press the Define button, then the OK button, and your new font will become the default.

The trouble with this is that Word inexplicably doesn't give you access to all the fonts in your System. The manual says nothing about it, but the fonts just aren't there. All isn't lost, though, because you can edit the menus. Press COMMAND-OPTION-+ and the cursor turns into a giant plus sign. (Although Microsoft calls it COMMAND-OPTION-+, you don't hold down the Shift key to execute this command, so purists would call this a COMMAND-OPTION-= key combination.) If you want to add an installed font to the Font menu, go into the Character entry on the Format menu and click on the font you want to appear in the Font menu. (All your fonts will appear.) The selected font will now show up in the Font menu. You can also add tab and paragraph formats to the Format menu, and even create an eighth menu called 'Work' that contains the names of frequently used documents and styles, putting them just a point and click away. Anything you add can be removed by pressing COMMAND-OPTION-MINUS and clicking on the entry you wish to erase.

You can use a similar technique to get help. Press COMMAND-?, and the I-beam turns into a giant question mark. (Again, since you don't hold the shift key down, this is technically a COMMAND-/combination, but COMMAND-? is a better mnemonic.) Pull down the item you want help with, and you get a quick refresher on it. If you need help with something that isn't on a menu, ask for help from the Apple menu.

Sneak previews

A word needs to be said about the page summary facility, which is one of the stronger parts of the program. When you've got your page the way you think you want it, with columns set up, proper font changes in and graphics located, you can see how the document will look



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Modems	Internal (1200/2400 baud)	■	■	■	■	■
	External (1200/2400 baud)	■	■	■	■	■
Connectivity	Format Converter	■	■	■	■	■
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Electronic Imaging	320 × 240 Resolution			■	■	■
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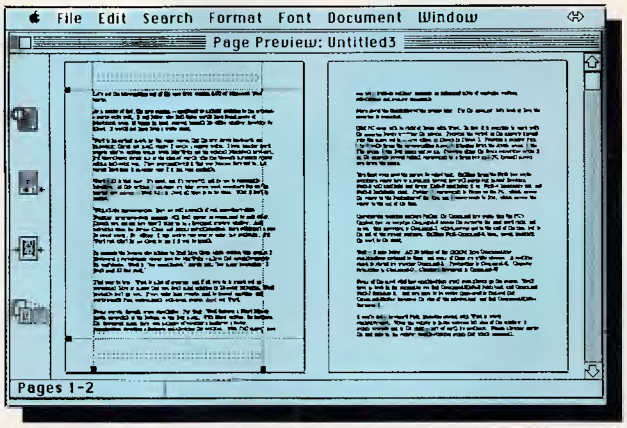
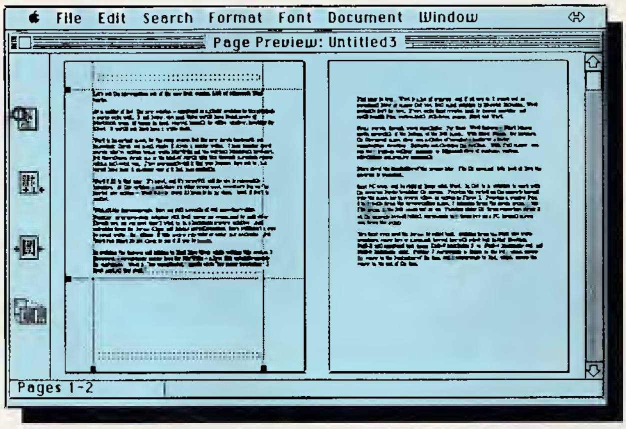


Selecting PAGE PREVIEW in the File menu gives you a WYSIWYG display of your document. Use either the magnifying glass icon or double-click on a spot to examine it more closely



Reset margins in Page Preview by selecting the Margins icon. The margin lines are displayed with handles that can be dragged to readjust width and page length

on paper by selecting Page Preview in the File menu.

To examine a spot on the page, either double-click on the spot you want to see, or click on the magnifying glass icon and drag it to that spot. To place a page number on the page, click on the page number icon and drag the number onto a page. If you don't want to see facing pages, click the lowest icon; click it again to get two pages on a single screen.

Most interesting is the margins icon. Click it and the margins are displayed, compete with handles. Point the mouse at one of the handles and drag any of the margin lines to where you want them. Release the mouse button and click somewhere off the page, and the document will reformat according to those new margins. If you only want to adjust a page break, you can drag the faint dotted line at the bottom of a page's text upwards; the text will reformat. The scroll bar on the right lets you page through the document, and the close box returns you to normal display.

The price of power

Word is powerful, but it is not flawless. Text brought in with the Clipboard is not in your default style, but is always in Geneva. A small pain, but an odd bother. It is not possible to print only odd or even pages — a problem when you're printing on both sides of a sheet of paper, as you would when printing something to be bound.

One bug warning. During one work session, while testing columns, repaginate and page preview, paginating started to act up. I was not able to reproduce the difficulty, and it only turned up once, but I don't think I was doing anything wrong at the time. It's an unresolved issue, though everything appears OK.

When everything is added up, there is far more to praise Word for than to damn it. Bugs in an earlier version make this program something of a target — guilty until proved innocent — but my testing doesn't show anything that would eliminate this program from active consideration.

Word may be more word processor than you want or need, but it's a solid power tool for processing heavyweight quantities of text. If you've got a big job, Word may be the package for you.

You've got my word on it.

END

Microsoft Word version 3.01 for the Macintosh sells for $790. Microsoft is on (02) 452 5088.

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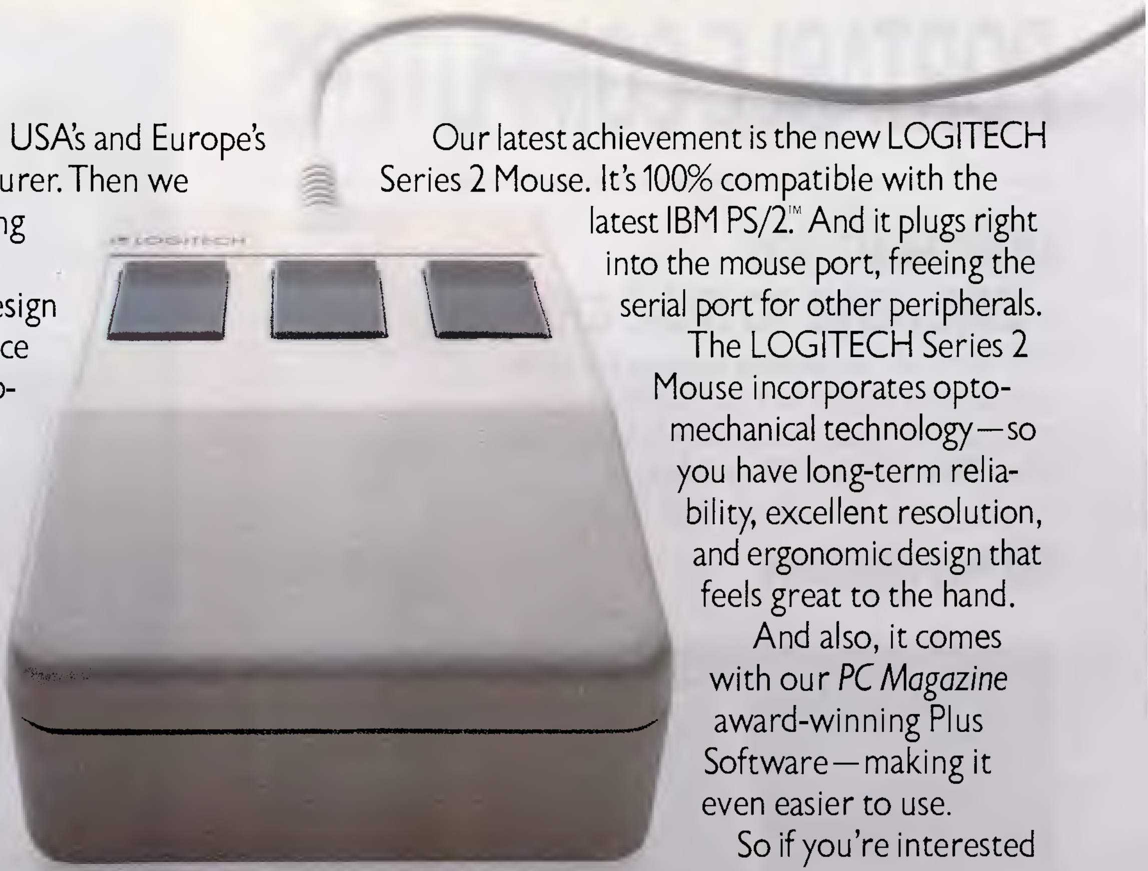

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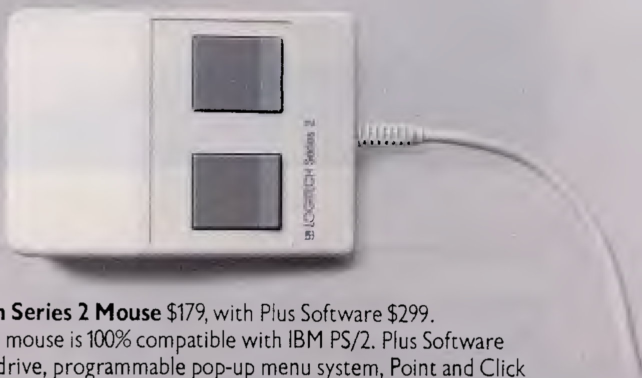

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Microsoft Bookshelf

A dictionary, a thesaurus, an almanac, a book of quotations, a style guide, a spelling dictionary, a postcode book and a news digest take up a fair amount of space on your bookshelf, so is it worth finding room for Microsoft's CD-ROM Bookshelf instead? David Tebbutt decides.

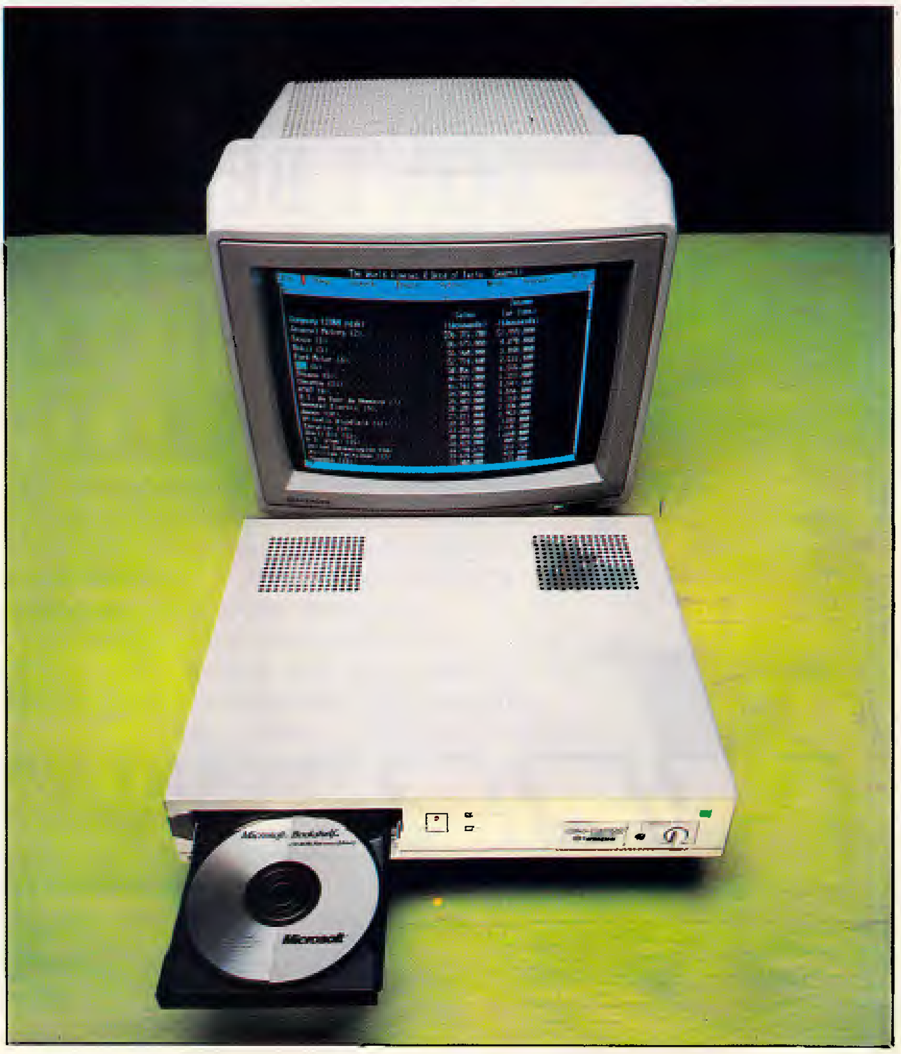
Microsoft claims that its soon-to-be-released CD-ROM Bookshelf will make your writing more precise and more interesting. It will do this by giving you instant access to thousands of items of information stored in a set of 10 electronic reference books. The company rather arrogantly claims that this is "probably the most valuable writing aid you'll ever use." Of course, that's just hype. There's no way that the very first implementation of a new technology can warrant that sort of claim. Even Lotus 1-2-3 built on what had gone before.

Lots of writers who want to impress their audiences start with a quotation. I'll therefore stick with this tradition and use Bookshelf to see if I can find a good quote which links the subjects of 'writing' and 'interest'. I put the cursor over 'writing', press a couple of keys, add the word 'interest' to a dialogue box, press Enter and up pops:

Chikamatsu Monzaemon
1653-1725

In writing joruri, one attempts first to describe facts as they really are, but in so doing one writes things which are not true, in the interest of art.
Chikamatsu Monzaemon
Preface to
HOZUMI IKAN, *Naniwa Miyage*

Bartlett's Familiar Quotations



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The quote is quite useless for my purposes, except to illustrate how easy it is to grab a relevant quote. After finding it and selecting it, I had to quit Bookshelf to reposition my cursor, then call the program up again to paste the quote into the right position.

To run Bookshelf, you need a CD-ROM player capable of understanding the so-called ‘High Sierra’ format. (Excuse me, while I see if ‘High Sierra’ is in the Almanac. It's there, but tells you nothing about CD-ROM formats.) The format was agreed between 13 players-to-be in the CD-ROM business. The group included Philips, Sony, Hitachi, Apple, DEC and Microsoft.

Despite Bill Gates' almost religious dedication to the concept of CD-ROM data storage, Microsoft has chosen a rather unusual and awkward method of distribution for Bookshelf. I should say “will chose” really, as Microsoft has yet to make the product available in Australia, although release is “imminent,” according to Phil Jones, a spokesman for the company.

When it does become available, you'll only be able to purchase it from CD-ROM drive vendors — not Microsoft.

Typically, CD-ROM players sell for between $1200 and $1800. One vendor likely to be bundling Bookshelf with its drive is Space-Time in Melbourne. Watch Newsprint for details over the coming months.

> *‘The product is inconsistent, especially the intelligence . . . simply to match text strings is not good enough when other applications in the same suite can display so much more native wit.’*

Bookshelf comes on a single CD-ROM disk and, of the potential capacity of 550Mbytes, only 156Mbytes has been used. You can hold the disk up to the light and see a clear contrast between the reflectiveness of the occupied and unoccupied areas of the disk. Microsoft has packed more than 1000 files on to the Bookshelf disk, including some sales demonstrations for its main product lines. There's also a rather yukky sell for Microsoft itself.

The product is designed as an online aid for any writer, whether they're into business memos, school essays or magazine articles. The present version is targetted at the American market so, unless you are an Americophile, you're likely to be frustrated by the bent towards reference works of that country.

For this review, I shall try to ignore the fact that the data is American and focus on the potential of this new medium.

Bookshelf is described as a CD-ROM reference library and comprises the following volumes:

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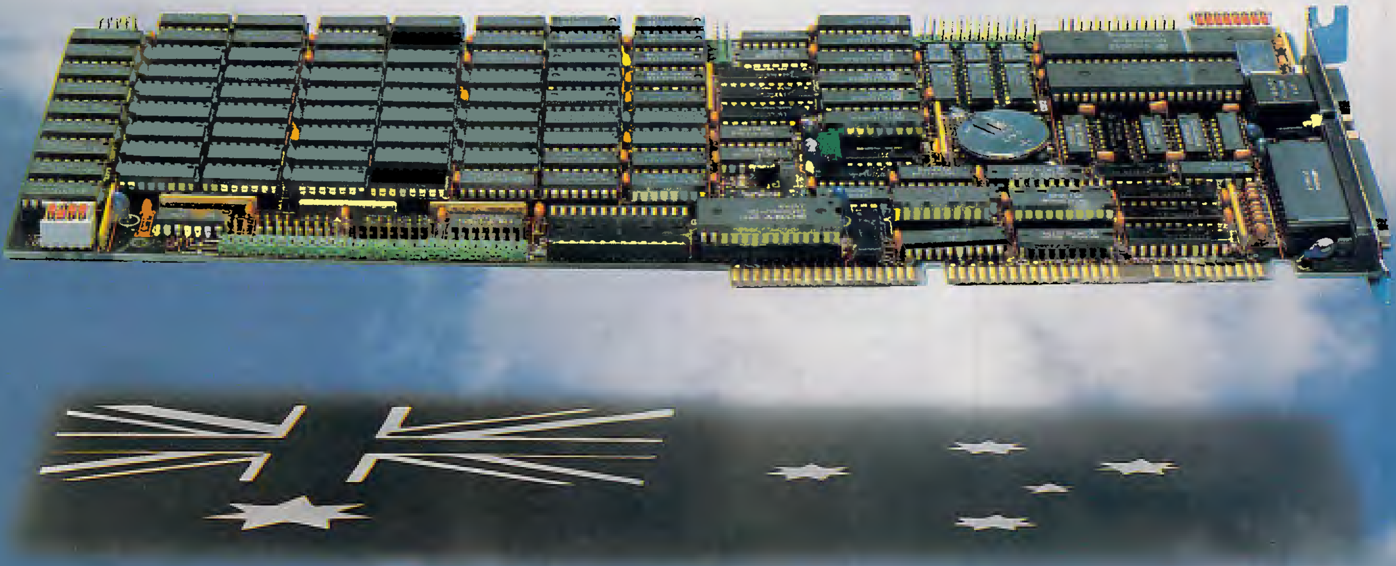

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Glenn Hart, PC Magazine
May 12, 1987, Page 36.

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The National Law Journal
June 29, 1987, Page 14.

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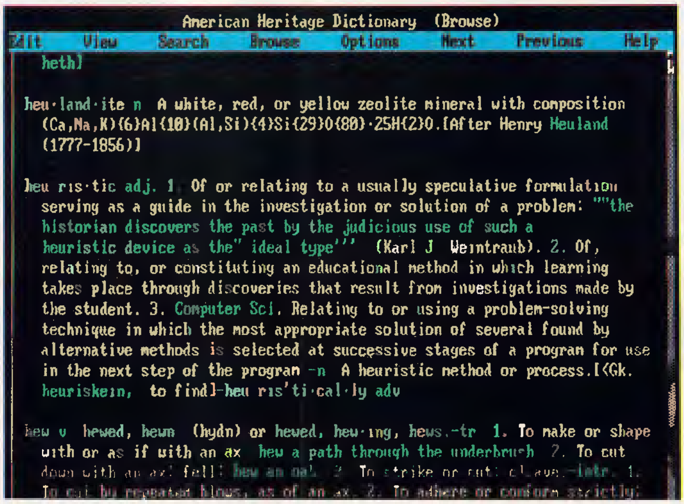

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  heth]

heu·land·ite n  A white, red, or yellow zeolite mineral with composition
  (Ca,Na,K){6}Al{10}(Al,Si){4}Si{29}O{80}·25H{2}O.[After Henry Heuland
  (1777-1856)]

heu ris·tic adj. 1  Of or relating to a usually speculative formulation
  serving as a guide in the investigation or solution of a problem: ""the
  historian discovers the past by the judicious use of such a
  heuristic device as the" ideal type''  (Karl J  Weintraub). 2. Of,
  relating to, or constituting an educational method in which learning
  takes place through discoveries that result from investigations made by
  the student. 3. Computer Sci. Relating to or using a problem-solving
  technique in which the most appropriate solution of several found by
  alternative methods is selected at successive stages of a program for use
  in the next step of the program -n  A heuristic method or process.[<Gk.
  heuriskein,  to find]-heu ris'ti·cal·ly adv

hew v  hewed, hewn  (hydn) or hewed, hew·ing, hews.-tr  1. To make or shape
  with or as if with an ax  hew a path through the underbrush  2. To cut
  down with an ax: fell: hew an oak  3  To strike or cut: cleave.-intr. 1.
  To cut by repeated blows, as of an ax. 2. To adhere or conform strictly:
```

Unlike the dictionaries included with word processors, the Bookshelf dictionary is complete with full definitions, derivations and pronunciation. Spell-checking can be performed using this version in conjunction with a personal dictionary

1987 World Almanac and Book of Facts
Bartlett's familiar quotations
The Chicago manual of style
A phonetically-based spelling checker
Forms, letter and outlines
ZIP codes
Houghton Mifflin Usage Alert
Business Information Sources

It comes with a Microsoft extensions disk which enables DOS to beat the 32Mbyte barrier and access the huge volume of data contained on the CD-ROM drive. It also contains the Bookshelf software which, when transferred to your PC, can be called from inside any application using your preferred hot-keys. Actually, your choices are limited to any combination of the two shifts, Alt and Ctrl, which is pretty mean of Microsoft because they're the ones that need the least programming effort.

As well as the 10 reference works listed on the main menu bar, a further two items offer you help and the chance to configure the system to your own preferences. The menu bar works in the now traditional fashion, with options selectable by arrow keys or by initial letter, whereupon a pull-down menu appears. Somehow, I'd expected CD-ROM applications to look a lot more exciting than this.

Installation

The Hitachi player comes with a connecting cable and a PC card. The cable can go either way round and the full-sized card simply pops into a spare slot. Internal drives are similar except that the connector fits on to the other end of the card. Apart from the fact that the cable is rather shorter than I'd like, because my machine stands under the desk, the physical set-up is very simple.

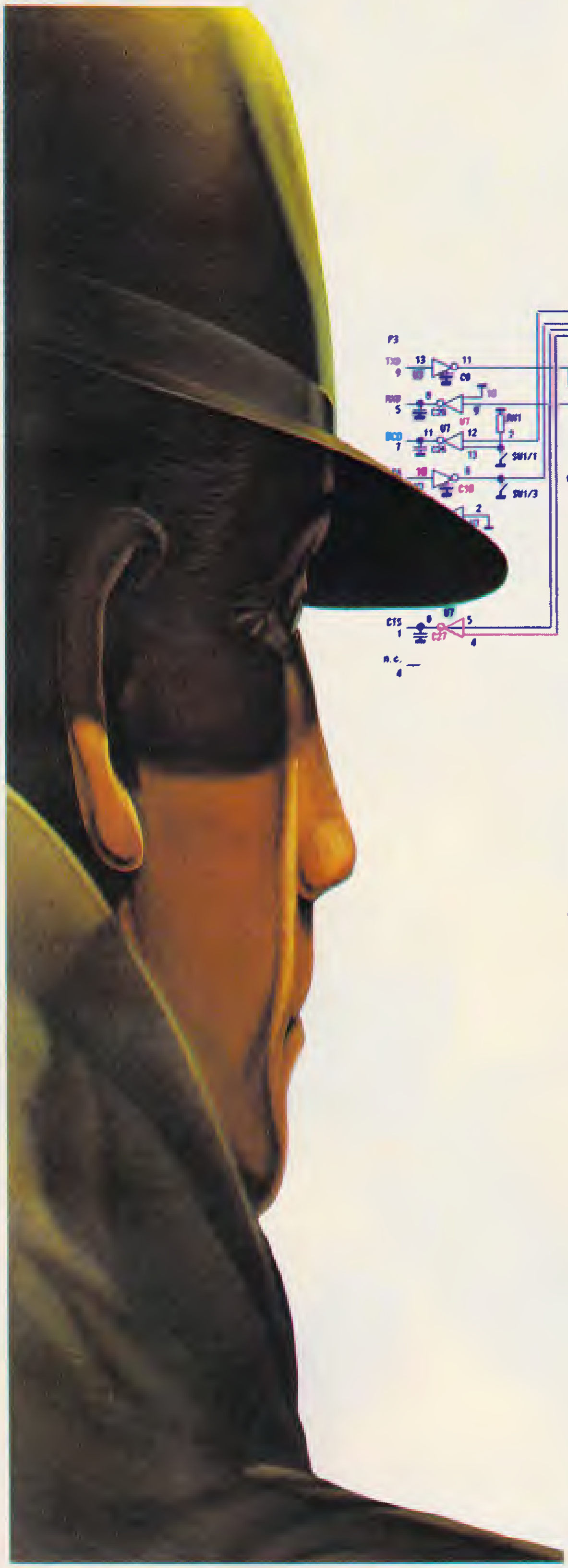
Or, at least, it would have been had I no problem with the Bookshelf disk. The disk, which wasn't new, had a series of hairline cracks radiating from the hub into the encoded section. These cracks were exactly where the boot tracks were, which resulted in read failures whenever I tried to access the disk. Of course, I suspected my set-up, so I tried the card in different slots, the cable different ways round and in each of the two rear sockets on the Hitachi drive, only to discover that it was a disk problem all along.

The software set-up is a bit of a pain because you have to patch your CONFIG.SYS and AUTOEXEC.BAT files to include some really arcane entries. The last drive needs to be Z, although the Hitachi is drive D; and a DEVICE entry reads: \HITACHI.SYS/D: MSCD001 /N:1. Quite what it all means, I've no idea. But that, coupled with some AUTOEXEC entries and some files you copy into the root directory, eventually give you access to the CD-ROM drive just as if it were a normal drive. This could have been considerably more user-friendly: I hope Microsoft automates the procedure a little more.

When you're on to drive D:, you type 'setup' which transfers programs and data from the CD-ROM into a sub-directory on your hard disk. Once in the hard disk, all that remains is to run the program 'BOOKS'. This loads the resident part of Bookshelf, leaving you to pop it up whenever you like. The hard-disk version of Bookshelf needs 512k memory, the floppy disk version 640k, and a non-resident version will run on a 256k system. All versions of Bookshelf require MS-DOS 3.1 or higher. A mouse is a worthwhile addition but isn't strictly necessary.

The only thing you might then want to do is to change the colours or the hot-keys. The default colours are cyan, black, white, brown and green — and that's it. The entire set-up process could be completed in half an hour or

THE CIA WOULD LOVE TO GET THEIR HANDS ON THESE.



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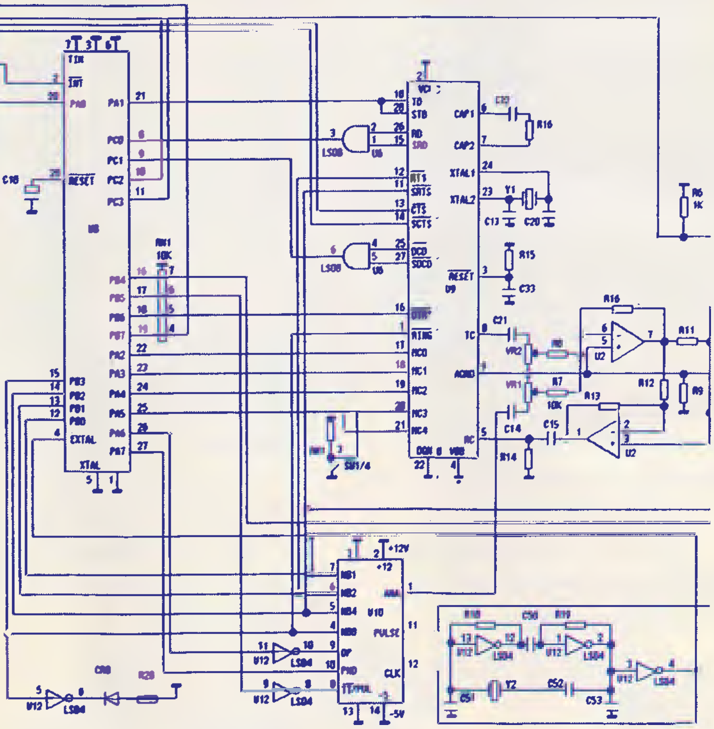

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so by someone who's reasonably familiar with computers.

The dictionary

The dictionary contains over 200,000 definitions, including extensions for people and places. You can access an entry by placing your cursor over the word you seek, activating Bookshelf and then either getting to the dictionary the long way, through menus, or direct with a strange combination of the Alt, Shift and letter D keys.

The entry you need comes up in three colours, with the entries above and below visible at the edges of the screen. If you've misspelled a word, or Bookshelf thinks you might mean something else, a window of alternatives appears so you can choose the entry you really want to see.

I was disappointed that, in the biography section, I couldn't get at Leonardo da Vinci through any part of his name, only the entire entry. Normally, the Biography searches on surname. I don't know if I'm weird, but I seem to have struck a high percentage of anomalies while using this product.

Thesaurus

The Thesaurus gives access to half a million synonyms and, as far as I can tell, not one of them is rude. Oh, I lie! I did look up 'bedding' quite innocently and discovered that the American synonyms are 'having', 'mating', 'copulating' and you can guess the rest. Anyway, having found a suitable alternative to the word you're employing, you can effect a substitution. (In that sentence, for example, I used the word 'employing' instead of 'using'.)

The blurb suggests that the Thesaurus can offer "a livelier and more precise alternative." It's quick, it's simple and I agree, it certainly beats wading through a paper Thesaurus. We're talking about one second to perform a normal search.

Almanac

This is the part of Bookshelf I couldn't resist. It contains all sorts of weird and wonderful information. According to the publisher, it contains more than a million facts. You can go straight to the index and browse up and down for something which catches your imagination or you might prefer to go in through the table of contents.

I hit trouble when using the index. I wanted some information on St Lucia, but when I went to the index entry I was routed to the Republic of Rwanda. It's ac-

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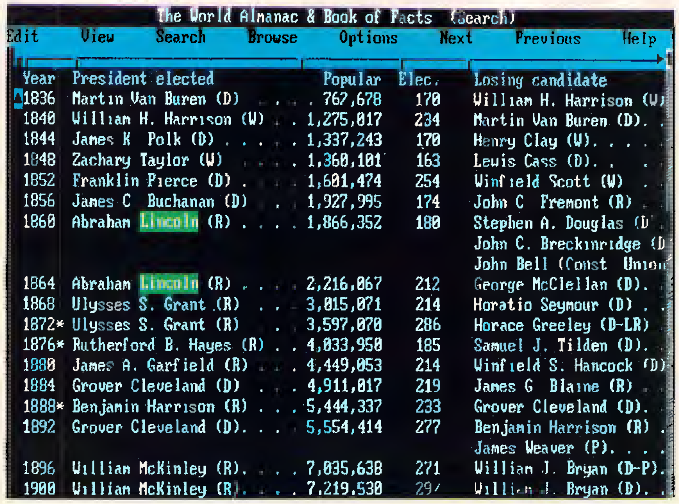

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              The World Almanac & Book of Facts  (Search)
Edit    View     Search    Browse    Options    Next    Previous    Help

 Year   President elected              Popular   Elec.   Losing candidate
 1836   Martin Van Buren (D) . . . . .   767,678   170   William H. Harrison (W)
 1840   William H. Harrison (W) . . 1,275,017   234   Martin Van Buren (D). .
 1844   James K  Polk (D) . . . . . 1,337,243   170   Henry Clay (W). . . . .
 1848   Zachary Taylor (W)  . . . . 1,360,101   163   Lewis Cass (D). .   . .
 1852   Franklin Pierce (D) . . . . 1,601,474   254   Winfield Scott (W)  . .
 1856   James C  Buchanan (D) . . . 1,927,995   174   John C  Fremont (R) . .
 1860   Abraham Lincoln (R) . . . . 1,866,352   180   Stephen A. Douglas (D .
                                                      John C. Breckinridge (D
                                                      John Bell (Const  Union
 1864   Abraham Lincoln (R) . . . . 2,216,067   212   George McClellan (D). .
 1868   Ulysses S. Grant (R)  . . . 3,015,071   214   Horatio Seymour (D) . .
 1872*  Ulysses S. Grant (R)  . . . 3,597,070   286   Horace Greeley (D-LR) .
 1876*  Rutherford B. Hayes (R) . . 4,033,950   185   Samuel J. Tilden (D). .
 1880   James A. Garfield (R) . . . 4,449,053   214   Winfield S. Hancock (D)
 1884   Grover Cleveland (D)  . . . 4,911,017   219   James G  Blaine (R) . .
 1888*  Benjamin Harrison (R) . . . 5,444,337   233   Grover Cleveland (D). .
 1892   Grover Cleveland (D). . . . 5,554,414   277   Benjamin Harrison (R) .
                                                      James Weaver (P). . . .
 1896   William McKinley (R). . . . 7,035,638   271   William J. Bryan (D-P).
 1900   William McKinley (R). . . . 7,219,530   292   William J. Bryan (D). .
```

Trivial Pursuit fans will have hours of fun using the Bookshelf Almanac. Up to three keywords can be combined when searching for references in the text. Over 1000 pages of text plus an index occupy less than one fifth of the disk capacity

tually two entries away from St Lucia in the Almanac. Tut tut. I also noticed that 'advertising' has been spelled wrongly in the index. You'd have thought that, with all these writing tools available, the publisher would have got its spelling right.

If you prefer a straight search for your chosen subject matter, you can define up to three expressions on which to search. A match on any of the three will make a hit and you will be taken into the fist entry which satisfies your criteria. 'Previous' and 'Next' options allow you to roam backwards and forwards through the list of selections.

When you reach an item of interest, you can pan up, down and, if the material on view is wider than your screen, sideways. You can collapse columns to bring those off the screen into view and, like some spreadsheets, you can lock columns in position to prevent them moving off the screen.

When you have the detail you want on display (and this applies to the dictionary, style manual, quotations, business information, forms and letters, too) you can select it with the mouse or Shift-Arrow keys and then copy it into a clipboard for later pasting into your document. Each time you do this, Bookshelf kindly appends a copyright notice.

I found that if I went too mad with the copy facility, my word processor (a fully-registered copy of PC-Write) actually choked on the input, effectively hanging my machine. You can copy up to 50 lines at a time from a Bookshelf document, so if you use the 'Append' option, you can build a very large clipboard file. If, like me, you have a periodic 'Save' option which asks for keyboard input by way of confirmation, you are in big trouble.

The paste operation works by kidding your application that the pasted information is coming from the keyboard. I presume that Bookshelf keeps repeating the next character due and, if that's not one which activates your save, you're in trouble. Either make a back-up before pasting large quantities of information, stick to smallish items, or use the 'Save Clipboard' option and import the saved file.

Given the intelligence of the spelling checker, which I'll come to in a minute, I'm astonished at the imbecility of the Almanac searching mechanism. It simply matches text strings. If you don't match, hard cheese. I tried to find Ricky Nelson (a pop singer when I was somewhat younger) — I drew a blank. Since he later changed his name to Rick Nelson, I tried that and got: 'Rick Nelson: "Hello Mary Lou" ', a song made when he called himself Ricky. Hmmm.

Quotations

Ah, yes. This was the very first thing I tried. A quote which has appealed to me ever since I worked in technical support is: "It is well-known that among the blind, the one-eyed man is king." Erasmus said that, so I tried to find it. No luck. I was quite disappointed until I remembered that this was an American publication and it did, after all, contain 22,500 other quotations, which is a fair number by anyone's reckoning. The *Bible's* there, so is Shakespeare, so it can't be all bad.

While I was rummaging through the quotations, the pulchritudinous Martin Banks telephoned me. (I was going to say 'lovely' but the Thesaurus offered that irresistible gem.) I thought I'd look up a quote which suited us writers. It came up with: 'A writer is like a bean plant — he has his little day, and then gets stringy.' We both put the phone down feeling quite deflated. Before hanging up, though, Martin made the important observation that, unlike a book of quotations which usually relies on you knowing the first line, this approach lets you find an apt quotation regardless of where the keywords appear. He's right, of course.

You can search the quotations by words and phrases, by author, by table of contents or by index. Once again, it beats the socks off using a paper book of quotations; and, even if I search on a common biblical term like 'thy', material appears on the screen in less than eight seconds.

Style manual

The search engine for the style manual is the same as that used in the quotations and almanac functions. It means you can find information on any aspect of producing a book, from its structure to how to use apostrophes properly. This electronic book is a mine of useful information and, like the others on this disk, lends itself well to the Bookshelf treatment.

Spelling checker

This checker is similar to many I've seen on PCs. (I looked up the use of apostrophes in the style manual for that sentence.) It checks the spelling of a single word or the entire screen. You may either replace all occurrences of a misspelled word or judge each one you reach on its own merits. You may ignore case, and you may elect for the checker to detect all words accidentally repeated.

The checker works on both a phonetic and string-matching basis. 'Reeding' produced 'reading', 'feeding' and 'needing' as alternative. I don't consider this checker to be particularly fast. It took about 11 seconds on my pretty snappy 80286 to check a 150-word screen. In constant use this would drive me crazy, but if your spelling's not up to much, it must be an attractive program.

Forms, letters and outlines

If you're the sort of person who needs a bit of a nudge to get going, then 'forms, letters and outlines' are for you. These are a whole pile — around 299k's-worth — of standard letters, agendas, form layouts and the like. Bookshelf contains nine copies of these, to suit the requirements of different word processors. Having found a document you like the look of, a 'Transfer' option bolts it straight into your word processor text.

The nine formats are straight ASCII, DisplayWrite, MultiMate, PCWrite, Volkswriter, Word, WordPerfect, WordStar

Continued on Page 200

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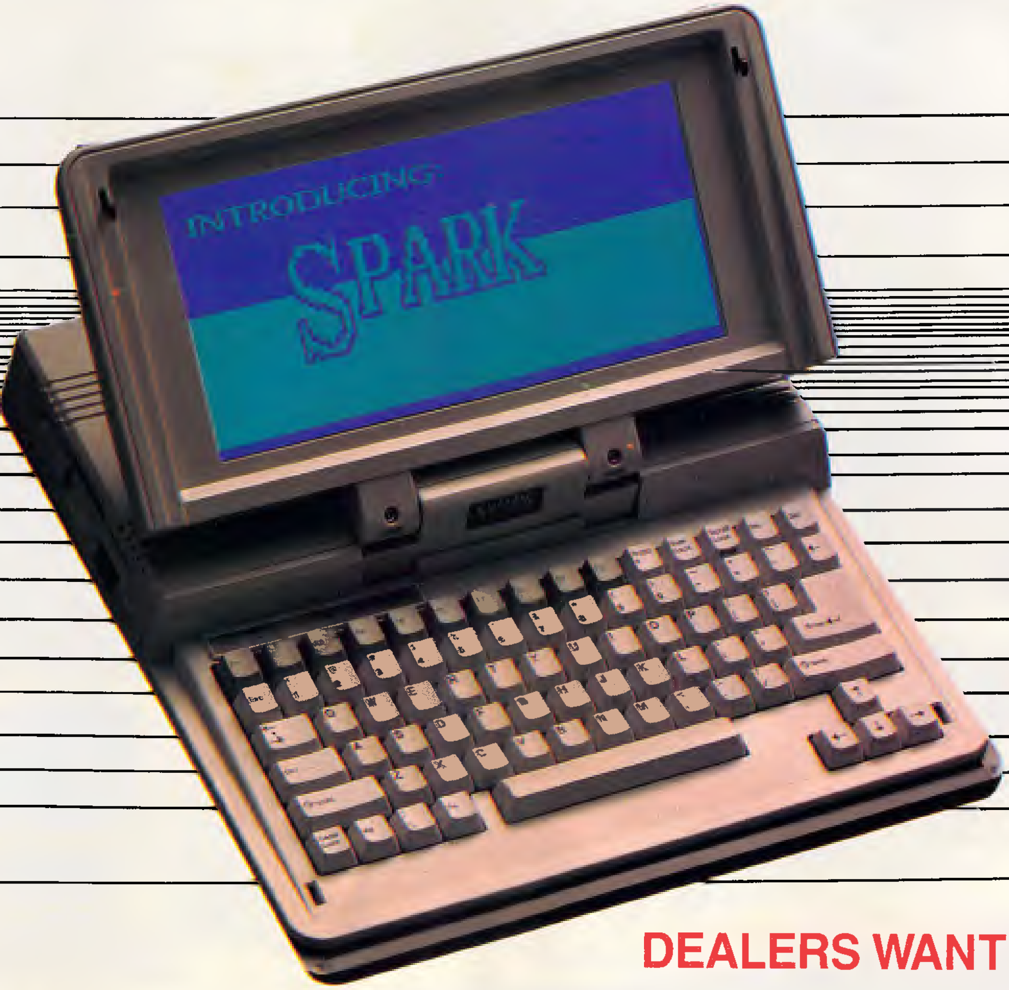

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All systems go

System Update 5.0 takes off to explore new applications, to seek out new networks, to boldly go where no Mac has gone before.

In the beginning was . . . was . . . well, we hit the nub of the problem right away. Part of the design of the Macintosh is that there is no 'operating system' as such, as there is on other computers. Instead, there is a triumvirate made up of the ROM, the System file, and the Finder. Many people think of the Finder as the Macintosh operating system, but it's actually just another program whose only really special capability (at least until now) is that other programs quit to it.

In the early days, this triumvirate was fairly transparent. All the user needed was a System disk, with the System file and the Finder on it to start up the Macintosh, and most application programs came on System disks. More adventuresome users knew that the System file was the repository of fonts and desk accessories, and could customise their Systems. But to most people, the operating system was still just the Finder.

As time went on, Apple needed to fix things and change things, and this was accomplished with new System files, new Finders and new printer drivers. These would be sent to dealers, who would copy them onto customers' disks, and to developers, who would include them on their product disks. The rate of change accelerated, too. System 2.0 and Finder 1.1g were replaced by System 3.0 and Finder 4.0, which were quickly replaced by System 3.1 and Finder 4.1, which were even more quickly replaced by System 3.2 and Finder 4.1. New printer drivers were needed and created for the LaserWriter and AppleTalk ImageWriter.

When the Macintosh SE, Macintosh II and AppleShare came along, things began to get even more complicated. There were now four versions of ROM (64k, 128k, 256k SE and 256k II) to deal with. Some versions of the System file worked best with some ROMs, others with others, and whether or not AppleShare was used made a difference. Version numbers began to blur. There was a System 4.1 and a Finder 4.1, but they didn't go together. Many Macintosh owners couldn't figure out what was happening, and finding out System versions was not always an easy task. The days of simply copying a System and Finder to update a System disk were gone.

> *'MultiFinder, while offering new ways to get the most out of your Mac, is still new and potentially unstable, depending on what applications are used with it.'*

With the latest version of System software, Apple has tried to simplify things. It has gathered all the pieces together onto four disks, documented in three manuals, and put the whole thing in a box which is about to be released for $99. It is called the Apple Macintosh System Software Update, and has one number, version 5.0 (but each component has its own version number; see the accompanying box). The box is clearly marked 'Required equipment: Macintosh Plus, Macintosh SE, or Macintosh II', since the new software requires at least 128k ROMs and one megabyte of memory. Putting this software update in a box with an order number and price encourages dealers to carry the update and get it to their customers, as well as simplifying life for Macintosh owners.

MultiFinder

The big change with this version of system software is the inclusion of the long-awaited MultiFinder (codenamed Juggler). MultiFinder is an enhancement to the Macintosh 'operating system' to allow multiple applications to run concurrently. MultiFinder consists of more than just the basic files which go into the System folder. It also requires a wide-ranging set of internal changes, implemented in changes to the System file and the Finder. It is the interrelationship of the MultiFinder files, System file, and Finder which pushed Apple toward the new method of distribution.

Despite its name, MultiFinder actually has very little to do with the Finder, and can be used with some of the third-party Finder substitutes on the market, such as PowerStation. But since most Macintosh owners think that the Finder is the Mac's operating system, the name 'MultiFinder' conveys the essence of what the product does.

MultiFinder builds on the base of Switcher's 'context switching' and adds capabilities for more program concurrency. Application programs which are 'MultiFinder-aware' can continue to use the Mac's processor when they are in the 'background' and the user is using

TERRY ALLEN

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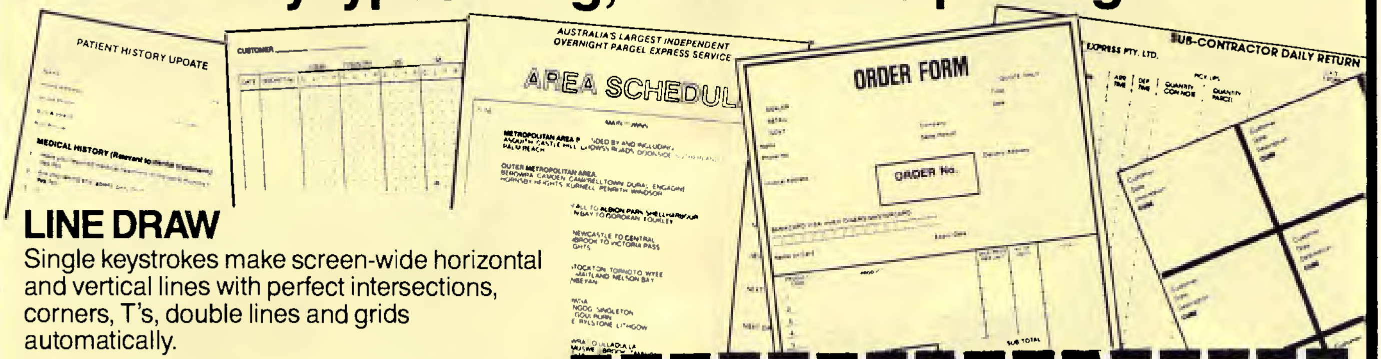

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Disk contents (Four 800k disks)

File/Folder Name	Ver	Description
System Tools 1		
System Folder	—	Folder
Clipboard File	4.2	System file
Color	3.2	Control Panel cdev file
DA Handler	1.0	MultiFinder file
Easy Access	1.0	INIT file
Finder	6.0	Finder
Key Layout	2.2	Keycaps DA file
Keyboard	3.2	Control Panel cdev file
General	3.2	Control Panel cdev file
Monitors	3.2	Control Panel cdev file (Mac II only)
Mouse	3.2	Control Panel cdev file
MultiFinder	1.0	MultiFinder
Scrapbook File	2.3	System file
Sound	3.2	Control Panel cdev file (Mac II only)
Startup Device	3.2	Control Panel cdev file (Mac SE & II only)
System	4.2	System
TeachText	1.1	Application program
Update Folder	—	Folder
Read Me	—	TeachText document
Utilities Folder	—	Folder
Apple HD SC Setup	1.5	Application program
Installer	2.5	Application program
Installer Scripts	—	Folder
Macintosh II Script	4.2	Installer document
Macintosh Plus Script	4.2	Installer document
Macintosh SE Script	4.2	Installer document
System Tools 2		
Installer	2.5	Application program
System Folder	—	Folder
AppleTalk ImageWriter	2.6	Printer driver
Background Printing	1.0	Installer document
Backgrounder	1.0	System document (print spooler)
Clipboard File	4.2	System file
Colour	3.2	Control Panel cdev file
DA Handler	1.0	MultiFinder file
Easy Access	1.0	INIT file
Finder	6.0	Finder
General	3.2	Control Panel cdev file
ImageWriter	2.6	Printer driver
Key Layout	2.2	Keycaps DA file
Keyboard	3.2	Control Panel cdev file
Laser Prep	5.0	LaserWriter prolog file
LaserWriter	5.0	Printer driver
PrintMonitor	1.0	Application program
Scrapbook File	2.3	System file
Sound	3.2	Control Panel cdev file (Mac II only)
Spool Folder	—	Folder
Startup Device	3.2	Control Panel cdev file (Mac SE & II only)
System	4.2	System
TeachText	1.1	Application program
Update Folder	—	Application program
Read Me	—	TeachText document
Utilities 1		
Apple HD SC Setup	1.5	Application program
Disk First Aid	1.3	Application program
HDBackup	1.0	Application program
System Folder	—	Folder
Clipboard File	4.2	System file
Colour	3.2	Control Panel cdev file
DA Handler	1.0	MultiFinder file
Easy Access	1.0	INIT file
Finder	6.0	Finder
General	3.2	Control Panel cdev file
Key Layout	2.2	Keycaps DA file
Keyboard	3.2	Control Panel cdev file
Monitors	3.2	Control Panel cdev file (Mac II only)
Mouse	3.2	Control Panel cdev file
MultiFinder	1.0	MultiFinder
Scrapbook File	2.3	System file
Sound	3.2	Control Panel cdev file (Mac II only)
Startup Device	3.2	Control Panel cdev file (Mac SE & II only)
System	4.2	System
TeachText	1.1	Application program
Update Folder	—	Folder
Read Me	—	TeachText document
Utilities 2		
Apple File Exchange Folder	—	Folder
Apple File Exchange	1.0.1	Application program
DCA-RFT/MacWrite	1.0	Apple File Exchange document
Font/DA Mover Folder	—	Folder
Desk Accessories	—	Font/DA Mover document
Fonts	—	Font/DA Mover document
Font/DA Mover	3.6	Application program

Documentation

Macintosh System Software Update User's Guide
Description of New Features
Updating Your Startup Disk
An Historical Perspective

Macintosh Utilities User's Guide
Apple HD SC Setup
Font/DA Mover
Apple File Exchange
Apple File Exchange: Advanced Features

MultiFinder User's Guide
Before You Begin
A Sample Session
Background Printing
Some Technical Points About Memory
The Set Startup Command
Tips for Working with MultiFinder
Troubleshooting

another application program or desk accessory. This means that time-consuming tasks such as disk back-ups, file downloading, spreadsheet recalculation and database sorting can be done while you work in a word processor or drawing program.

MultiFinder comes with some support files, including DA Handler, which creates a special MultiFinder 'layer' for desk accessories to inhabit, which allows (or forces, depending on your perspective) all desk accessories to be 'brought to the front' at the same time. MultiFinder also includes a built-in LaserWriter printing spooler called BackGrounder which has a companion application program called PrintMonitor to track the progress of printing and control the scheduling of print jobs. PrintMonitor includes a 'print at specific time' feature, a nice touch.

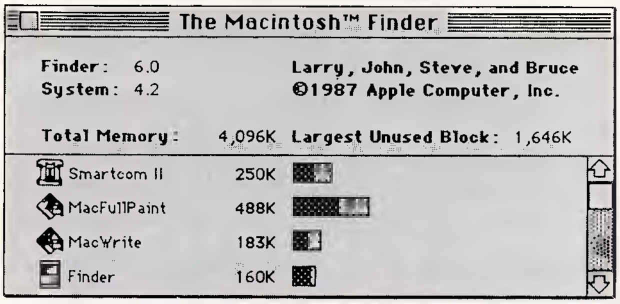
MultiFinder has received mixed reactions from program developers. The capabilities are appreciated, but the extra effort required to take advantage of them is not. Also, in order to ensure future compatibility, Apple has had to declare some sections of the operating system 'off limits', and developers must wait for the 'final' incarnation of MultiFinder to find out how to perform some of the tricks they have used in the past.

MultiFinder is the bridge between the old Macintosh operating system and a true multi-tasking operating system. It is an excellent effort, but a mixed blessing. During the transitional period, there will be compatibility problems and an increased number of ways for an application to fail, since Macintosh applications have never had to be careful not to step on other applications' toes before.

System and Finder

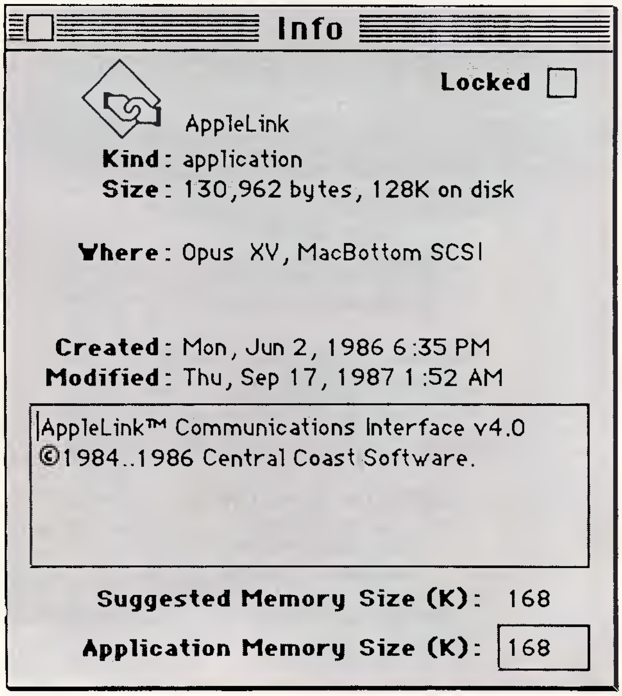
The core of System Tools 5.0, as the update is also called, is System version 4.2 and Finder version 6.0. The major change in these versions is support for MultiFinder. There are also many minor changes and bug fixes, and improved colour support for the Macintosh II.

In the Finder, the 'About the Finder' choice under the Apple menu now displays the current System version as well as the Finder version, and shows the memory usage similar to the way Switcher handles memory display, which is useful when using MultiFinder. On a Macintosh II, there is also a new Colour menu used to set icon colours. The SET STARTUP choice has been modified as well, and allows you to specify whether to start up using MultiFinder or not. Setting startup without MultiFinder works as SET STARTUP did in the past, making the selected application the startup application. Setting startup with MultiFinder uses the currently running application(s). A minor enhancement to the Finder allows files to be copied from one folder to another on the same disk by holding down the Option key when selecting and dragging the icon.



Finder: 6.0
System: 4.2
Larry, John, Steve, and Bruce
©1987 Apple Computer, Inc.
Total Memory: 4,096K Largest Unused Block: 1,646K
Smartcom II 250K
MacFullPaint 488K
MacWrite 183K
Finder 160K

The 'About the Finder' choice under the Apple menu now gives memory information about the applications that are open



Locked ☐
AppleLink
Kind: application
Size: 130,962 bytes, 128K on disk
Where: Opus XV, MacBottom SCSI
Created: Mon, Jun 2, 1986 6:35 PM
Modified: Thu, Sep 17, 1987 1:52 AM
AppleLink™ Communications Interface v4.0
©1984..1986 Central Coast Software.
Suggested Memory Size (K): 168
Application Memory Size (K): 168

The 'Get Info' choice under the Finder's file menu allows you to set the desired memory size for each application program you want to use under MultiFinder

The changes in the System file are invisible to the user, but are there nonetheless. One thing you may notice is how much larger this System file is than earlier versions. One reason for this, is that this System file provides many of the functions in the SE and Mac II ROMs to Macintosh Plus users, and there are resources required for all three computers. By using the Installer program described later on, the size of the System can be controlled somewhat.

Printer drivers

System Tools 5.0 includes new drivers for the ImageWriter, the AppleTalk ImageWriter and the LaserWriter. Most of the changes from the immediately preceding versions are minor and transparent to the user, but if you are upgrading from older versions you may be pleasantly surprised by the changes that have crept in over the last few updates.

In the LaserWriter driver, for example, the Page Setup dialog has been enhanced to allow options such as flipping the page image horizontally or vertically, inverting the image, using precision bitmap alignment and using a larger print area. Most people will never need these options, but the capabilities are there when needed.

Modular control panel

If you are upgrading from Systems prior to 4.0, you will discover the Control Panel has changed considerably. The new Control Panel is modular, and uses 'cdev' files (for CControl DEVice) that allow you to customise your control panel. Several third-party developers have released software that makes use of this option to be managed from the control panel.

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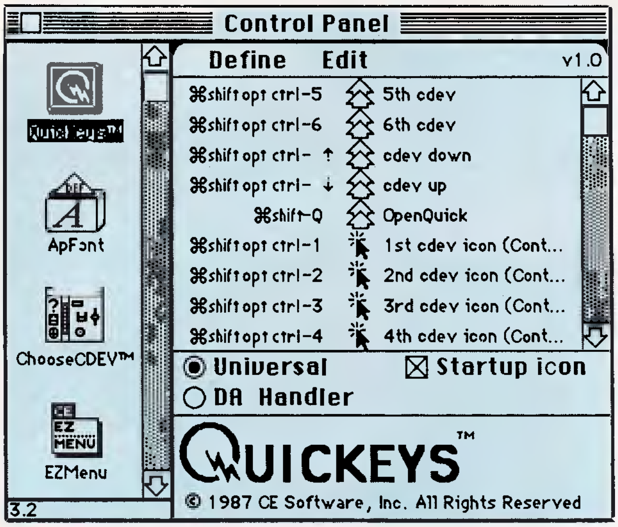

v1.0

⌘shift opt ctrl-5	5th cdev
⌘shift opt ctrl-6	6th cdev
⌘shift opt ctrl- ↑	cdev down
⌘shift opt ctrl- ↓	cdev up
⌘shift-Q	OpenQuick
⌘shift opt ctrl-1	1st cdev icon (Cont...
⌘shift opt ctrl-2	2nd cdev icon (Cont...
⌘shift opt ctrl-3	3rd cdev icon (Cont...
⌘shift opt ctrl-4	4th cdev icon (Cont...

● Universal ☒ Startup icon
○ DA Handler

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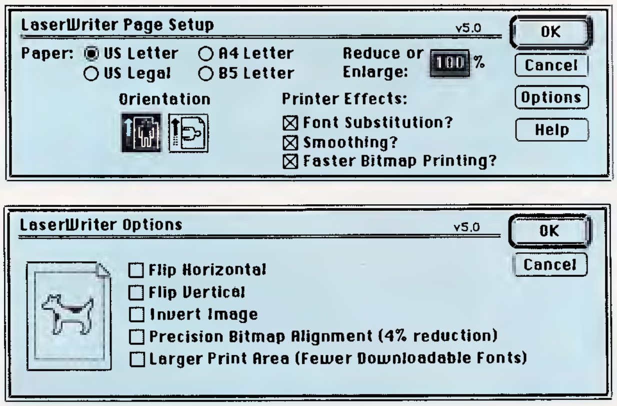
The icons down the left side of the Control Panel represent the available functions. The selected function is highlighted



LaserWriter Page Setup v5.0

Paper: ● US Letter ○ A4 Letter ○ US Legal ○ B5 Letter
Reduce or Enlarge: 100 %
Orientation
Printer Effects:
☒ Font Substitution?
☒ Smoothing?
☒ Faster Bitmap Printing?

LaserWriter Options v5.0

☐ Flip Horizontal
☐ Flip Vertical
☐ Invert Image
☐ Precision Bitmap Alignment (4% reduction)
☐ Larger Print Area (Fewer Downloadable Fonts)

The new LaserWriter driver allows more of the power of PostScript to be tapped with its additional print options

Many of the cdev modules that come with System Tools 5.0 are for the Macintosh II, including a new one called 'Color' that allows you to change the highlight colour, the colour used as a background when text or an icon is selected. The General cdev also adds the ability to set the desktop pattern colour on a Macintosh II.

Odds and ends

Chooser has been enhanced to allow devices to be selected in different AppleTalk zones, as well as to turn background printing under MultiFinder on and off.

The Find File desk accessory may also be new to you, and is used to locate files which can be moved to the desktop and put away later with the Finder's Put Away menu choice. Easy Access is a file which allows you to turn on two new features, 'sticky keys' and 'mouse keys', which are designed to help people who have difficulty typing or using the mouse.

Installer

One problem in the System update process discovered early on was that users who had customised their System files with fonts and desk accessories were reluctant to move to a new System and re-customise. As a result, Apple developed the Installer, a program that updates older System disks.

The Installer works with scripts which tell it what to do, and System Tools 5.0 comes with three scripts, one each for the Macintosh Plus, SE and II. Based on the script, the Installer gets the necessary resources from the System Tools disk and installs them into the System folder being updated. In this way, existing fonts and desk accessories are left intact in the System file being updated.

The Installer can also be used to update your printing resources, and using the Installer on the System Tools 2 disk will present a choice of printers to update.

Utilities

System Tools 5.0 comes with several utility programs. Apple HD SC Setup is for users of Apple SCSI hard disks. Font/DA Mover is, as its name states, for moving fonts and desk accessories around and can be used to customise your System. TeachText is a special-purpose word processor used to create files which cannot be modified, such as the 'Read Me' files which come on the System Tools disks. HD Backup is an adequate hard disk backup program, though many users prefer the third-party alternatives such as SuperMac's DiskFit and PCPC's HFS Backup. Disk First Aid is an emergency disk repair program which can be used in a last attempt to recover data from a damaged disk before reinitialising. Apple File Exchange is a translator for Apple II ProDOS and MS-DOS files, and is a skeleton on which additional translators can be provided by third-party companies.

Documentation

System Tools Update 5.0 comes with three manuals: a brief 29-page User's Guide which describes the features of the update and how to use the Installer program; a 35-page MultiFinder User's Guide which covers using MultiFinder, using the background printing feature and offers some tips; and a 108-page Utilities User's Guide which is the manual for Apple HD SC Setup, Font/DA Mover, TeachText, Find File, HD Backup, Disk First Aid and Apple File Exchange.

As with other end-user Macintosh documentation, the coverage is broad and not very deep, but the manuals serve to introduce the major features and usage of the various components. For example, the MultiFinder manual doesn't mention the problem that many users discovered downloading files, so they must learn elsewhere that files need to be downloaded to closed folders.

Conclusion

System Tools 5.0 represents good value. The enhancements, while mostly minor, are almost all useful. MultiFinder, while offering new ways to get the most out of your Mac, is still new and potentially unstable, depending on what applications are used with it. Overall, however, this is the most fully tested and stable version of Macintosh System software in some time. If you have a Macintosh Plus, SE or II, you should upgrade and take advantage of the new features and improvements as soon as this product goes on-sale. Just be careful when experimenting with MultiFinder, and, as always, save and back up frequently.

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It's all in the symbols

Numbers aren't everything; in fact, the 'things' that they can represent might be in the minority, according to Merrill Cornish.

We've always had symbols as names; now we're investigating symbols as numbers. We tend to relate what we hear to what we already know. Numbers are what we already know, so we tend to think of symbols as numbers, or as representing numbers; but symbols aren't numbers. And symbolic processing is *not* just another way of saying numeric processing.

Symbols are not truly symbols when they are used as variable names. Conventional programming languages use the term 'symbol' to mean the name of a program variable. Lisp has variables named by symbols, but they aren't the same as the symbols we are discussing.

What makes symbolic processing symbolic is that the values a variable is allowed to assume now include other symbols as well as the traditional numbers. For example,

```
(setf a 1)     ;assignment of a number value
(setf b 'a)    ;assignment of a symbol value
a => 1         ;value of a is the number 1
b => a         ;value of b is the symbol a
```

One common misconception is that symbolic processing is artificial intelligence. While AI would probably be impossible without it, symbolic processing is also useful for things unrelated to AI. Another misconception is that you use symbolic processing so you don't have to explicitly declare the types of your numbers. If you need type checking for your numbers, you might want to use Lisp, but you don't necessarily need symbolic processing.

A third misconception is that symbolic processing means you do garbage collection. Not true; garbage collection can benefit any language — numeric or symbolic — that allows you to allocate runtime data. Its usefulness is not restricted to symbolic processing.

Now you know what symbolic processing is *not*, but what *is* it? In reality, symbolic processing means processing non-numeric 'things' that we can't reasonably represent as numbers. Thus, we represent these things as symbols. Symbolic processing is the natural complement of numeric processing. First, however, we must accept that there is something other than numbers.

With Cobol, Fortran, Pascal, C, and so on, we've been quietly indoctrinated to believe that data is numbers. While there's nothing wrong with that premise in context — that is, within the limits of procedural languages — the power of computing extends a lot further. This article describes how symbols differ from numbers, why we can't use numbers where we need symbols, and how the things we need symbols for are unique and valuable.

What is numeric processing?

Venerable Fortran II supported only numeric data types. Fortran IV added logical data types. Cobol added more numeric types, such as packed decimal and an almost non-numeric data type, characters. Characters were invented to record non-numeric things, but we all *knew* that they were really small integers that always fit into 8 bits.

Since Fortran, most language designers have accepted the implied dictum: Data is numbers. And yet, the question 'Are numbers enough?' always existed. As a partial response, Pascal's designers included sets, and C's developers recently added enumeration types.

But these two concessions to non-numeric processing still have conveniently numeric internal representations. A set is really a one-dimensional array of 1-bit integers, while an enumeration resembles the assembly language practice of equating names to successive integers.

Numeric processing is a definite success story. The problem lies in our assumption that since it has been used for everything we've thought of so far, it should be used for everything we *can* think of.

It's all in the data types

If, as an experienced programmer, you are given a choice of any implementation language you wish to use for an application, your choice would probably be fairly predictable. For vector number-crunching applications, you would probably use Fortran; for business data programming, C; and so on. These choices have nothing to do with which language is best; they are purely pragmatic. Each particular language offers the data types and data structures needed to clearly and concisely describe a specific type of problem, plus the library functions to manipulate those structures.

For example, let's suppose you need to read a text file and produce a sorted list of words, the number of times each word occurs, their average length, and so on. How would you implement this program in Fortran 66, which has neither a character data type nor a string data structure?

Nothing's impossible. You could use Fortran's A1 format to read characters into an array. You could mimic string storage by maintaining pairs of start/end indexes into that array, one pair per string. You could make the dimensions of the various fixed-sized arrays larger than you'll ever need. You could write Fortran functions to access these pseudostrings, compare them for equality, order them, print them, and so on. You could make it work, but would you want to? You would have already written a significant amount of Fortran code before you even considered the original application.

However, there is a better solution. Consider the relative ease with which you could implement this application in C. C already understands that characters are characters and not stunted integers. C already knows how to store characters in strings. The standard C libraries already contain the necessary character-manipulation functions, such as strlen, strcmp, strcpy, and so on.

In short, C has the data types and data structures to support the application, and Fortran 66 doesn't. With C, you start programming the application immediately. With Fortran, you start by creating a virtual language within which you can then implement the application. When you do finally get to coding the application itself, the in-line Fortran housekeeping needed to make arrays of integers look like strings of characters constantly intrudes on the logic of the application. Fortran doesn't provide the 'abstraction' we need for this problem; C does.

Symbol data types

In high-school English, many of us had to diagram sentences by breaking them into clauses, phrases, subjects, verbs, and so on. What if you had to implement such an analysis in a program? Remember, we aren't talking about understanding; we don't care what the sentences *mean* — we just want to classify the words in them.

While C has excellent string-handling capabilities, this is not a string problem; it's a symbol problem. C's string-handling facility is mainly interested in the physical aspects of string representation. Given the words 'is', 'was', and 'were', C's 'strlen' function could tell you that they are two, three and four characters long, respectively. But we need to know that they are all verbs, not nouns, adjectives, or adverbs; that 'is' and 'was' are singular while 'were' is plural; and that 'is' is present tense while 'was' and 'were' are past tense. Also, given the words 'are' and 'ARE', C's 'strcmp' function would tell you that they are different, although they are the same word.

C is doing what it is supposed to do. C is interested in the characters in a string, but we are interested in the *word* represented by the string and in its grammatical properties. C sees the word as a collection of individual characters and is unaware of any higher meaning to that collection. In other words, this time C

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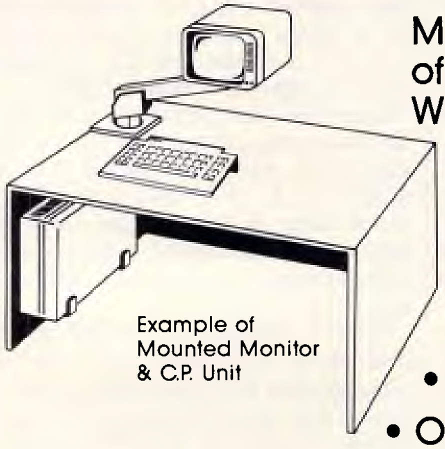

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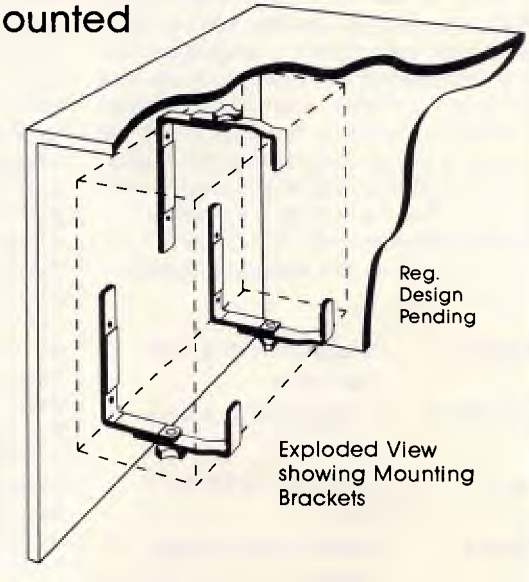

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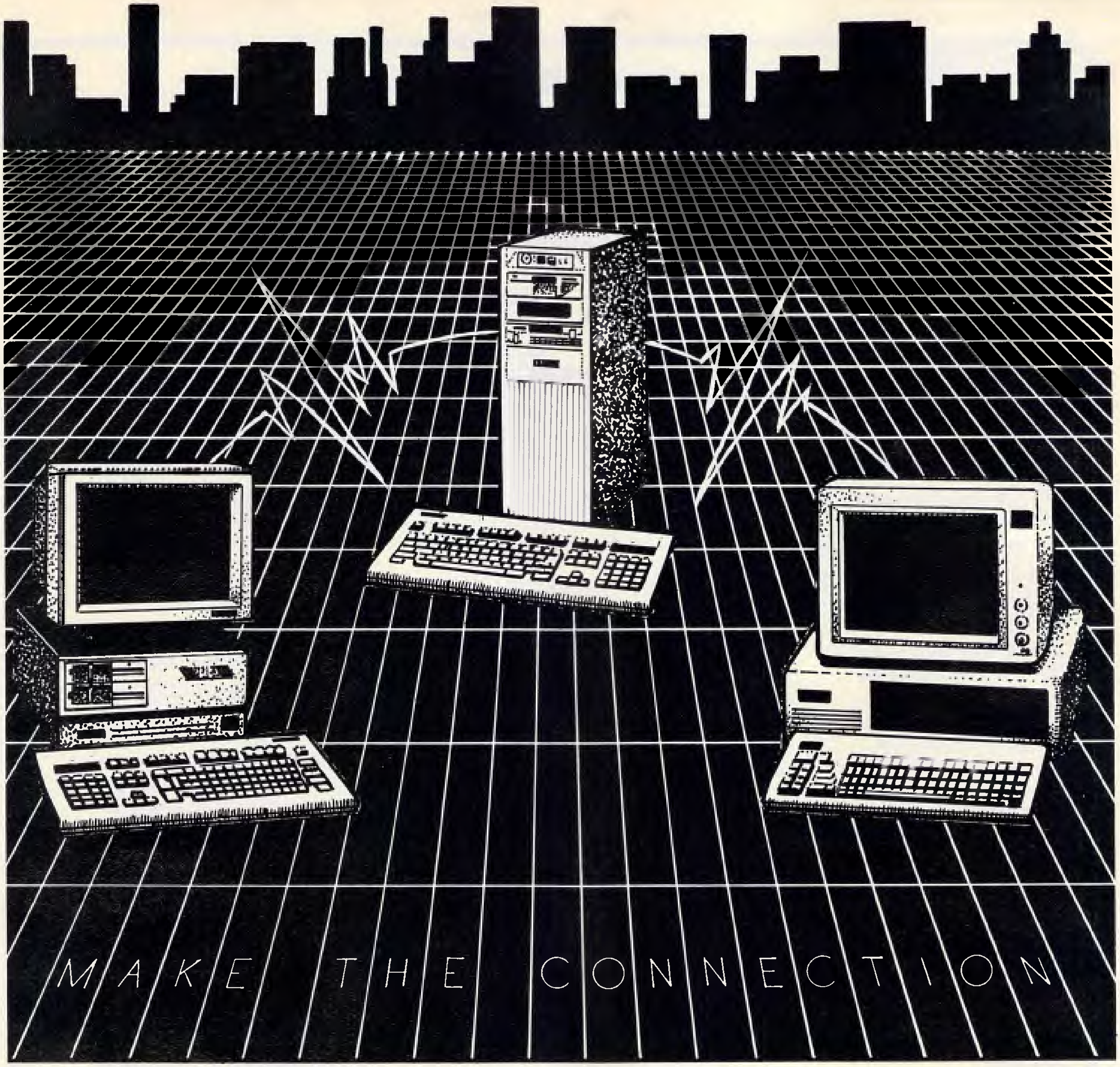

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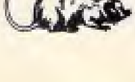

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doesn't provide the particular abstraction that we need.

Why strings won't do

So far, we've seen how a true symbol data type would simplify our implementation. But, even if a string-based implementation isn't our first choice, shouldn't it still be an acceptable second choice?

The real question is: how acceptable is the extra code you have to write to get C to see the big picture and stop dealing with words as bags of characters?

For example, C programmers sometimes use strings as symbolic mnemonics, such as the string argument 'r' telling 'fopen' to open a file for reading. It's not always appropriate, however, to try to distinguish symbols by their printed representation. Consider the sentence: 'BILL PAID HIS REPAIR BILL'. Is the first BILL equal to the second BILL? C's 'strcmp' function would think so.

Once your analysis determines that the subject is BILL and the object is BILL, then a C program would claim the sentence's subject and object are the same. But they aren't. The subject is a man, and the object is a piece of paper. The fact that this particular subject and object happen to have the same printed representation is merely coincidence.

The notion of symbolic data types introduces distinctions that never seemed important with numeric data types. For example, the Lisp predicate 'eq' compares two symbols to see if they represent the same object, the same piece of memory. Therefore, (eq 'subject object') would return false since BILL, the subject string, is physically a different data structure from BILL, the object string. They are two different objects that just happen to be represented by the same characters.

The Lisp predicate 'equal' compares the contents of two objects rather than the objects themselves. As a rule, if two objects print the same, 'equal' will say they are the same. So in Lisp,

```
(eq subject object) => false
(eq subject subject) => true
(equal subject object) => true
```

The point is that when you deal with symbolic data types, you need more than the plan bit-pattern comparisons that number crunchers use.

The power is abstraction

Programmers have a vested interest in abstraction. Alan Turing showed us that even a very rudimentary machine can compute almost anything imaginable. But the process of programming a Turing Machine is tedious. Abstraction is one of the things that makes programming bearable.

At the binary level, understand the abstraction, the code breaks down to all ones and zeros. But the point of a programming language is to provide an abstraction that suppresses the things we don't care about while leaving the features we consider important out in the open and available. Furthermore, as we go from one application to another, our notion of what's important can shift radically.

Fortran provided us with at least three major abstractions that have appeared in virtually all languages since: 'DO' loops, floating-point numbers, and I/O statements. While there are many ways of writing as loop, Fortran programmers are more interested in what's inside the 'DO' loop than in the mechanics of indexing; so Fortran included a 'DO' loop abstraction. Floating-point representations are a whole field of study, but Fortran programmers needed to *use* floating-point numbers, not study them; so Fortran included a floating-point abstraction.

And everyone needs to do I/O, but few want to write yet another ASCII-to-integer conversion. So Fortran included a 'FORMAT' statement. (You might well argue that a Fortran 'FORMAT' statement is *not* the best of all possible worlds, but that's not the point. Even 'FORMAT's' arcane syntax still lets you think more in terms of what you want printed than how to output each character).

Despite Fortran's successes, its array abstraction doesn't do too well on the word-counting application. The meaning of any number in a Fortran array is independent of any other number in that array. In contrast, a character in a C string has little meaning by itself. Instead, all the characters in the string taken together have a meaning. This distinction of individual meaning versus group meaning isn't just a pedantic nicety: it underlies why C does better than Fortran at itemising words in a file.

However, when we try to parse a sentence, C's abstraction of strings as a collection of related characters doesn't help much. We don't want to spell the words; we don't even care what the words are; we just want to identify their respective parts of speech. C's abstraction isn't wrong; it just isn't the one we need.

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Verbosity and fragility

Working without the abstractions you need exacts a definite cost in verbosity and fragility. The verbosity is due to the additional source code you must add to do the things that a language with a more appropriate abstraction would have done for you. You can hide much of this source code inside function calls, but too much of it usually ends up in the form of manual programming conventions.

For example, a complex number is made up of a pair of ordinary numbers called its real and imaginary parts. Since Fortran was designed with abstractions for numerical analysis, it had complex numbers from the start. If you have declared A, B and C as complex numbers, then the simple statement A = B x C is sufficient to cause the real and imaginary parts of B and C to be multiplied, recombined, and stored into the real and imaginary parts of A.

However, if Fortran didn't have complex numbers, we would have to handle the process ourselves. First, to represent a complex number, we could use a one-dimensional array of two elements for its real and imaginary parts. What would a simple multiplication of two complex numbers, A = B x C, look like?

```
A(1) = B(1)xC(1) - B(2)xC(2)
A(2) = B(1)xC(2) + B(2)xC(1)
```

The best abstraction that we could devise in Fortran would probably be a complex multiply function, such as 'CMULT' (A,B,C), which is an improvement, but the fact that you don't have a true complex-number data type still shows.

Given the statement A = B x C in Fortran IV, where variable names beginning with A have been declared to be implicit complex numbers, the language's automatic memory-allocation abstraction would have allocated A for you. But before you used the 'CMULT'(A,B,C) function above, you would have had to declare A yourself as 'DIMENSION' A (2). Custom functions (and macros) can make do-it-yourself abstraction-building less painful, but the pretender still isn't as good as the real thing.

The actual load/add/store sequences executed by the hardware in these examples are identical. The difference is the level of abstraction available to the programmer. The lack of an appropriate abstraction is a definite programming liability.

In addition to being more verbose, your code also becomes more fragile, because the verbosity exposes more of the language's housekeeping as source code. The extra code provides more opportunity for errors, which can be introduced by anything from typographical errors to overlooking a special programming convention (ie, when you did *this*, you forgot to do *that*). The code is also subject to errors due to its lack of intuitiveness. You could mistake it for a fragment of matrix multiplication; if you can't fathom its purpose, you can't be sure if it needs fixing.

The next step

This discussion of abstractions leads us to three real points:

- Each problem has its own preferred set of abstractions. If the programming language you are using doesn't provide the relevant abstractions, you will have to code them yourself.
- Conventional languages almost universally provide abstractions of numeric things and can perform numeric processing. Languages that provide abstractions of non-numeric things can perform symbolic processing.
- The historical progress of computing is closely tied to the available abstractions — that is, the available programming languages. Symbolic processing is the next evolutionary step.

Of all the things that exist in the world and in our minds, we need to be able to abstract them before we can represent them in the ones and zeros of a computer. At present, abstractions have not wandered too far from the concept that data is numbers. Now, we are beginning to suspect that the things in this universe that numbers can represent may be in the minority.

Our progress beyond the bounds of numbers has come in stages. First, we found that symbolic operands couldn't always be represented in a 32-bit memory word, so we set up pointers as a general data representation.

Next, we found that there were relationships too complicated to be described in a multi-dimensional array, so we devised trees.

Then, we found that memory usage was too sophisticated for static allocation, so we created dynamic run-time allocation and de-allocation. Now, we are finding a need to process symbols that don't represent numbers. The idea of symbolic processing began when we first realised that data needn't be numbers; we have yet to see all the possibilities of that idea.

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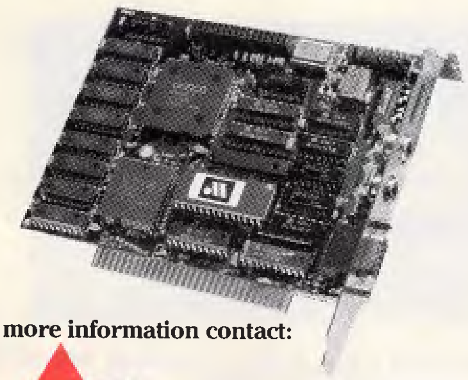

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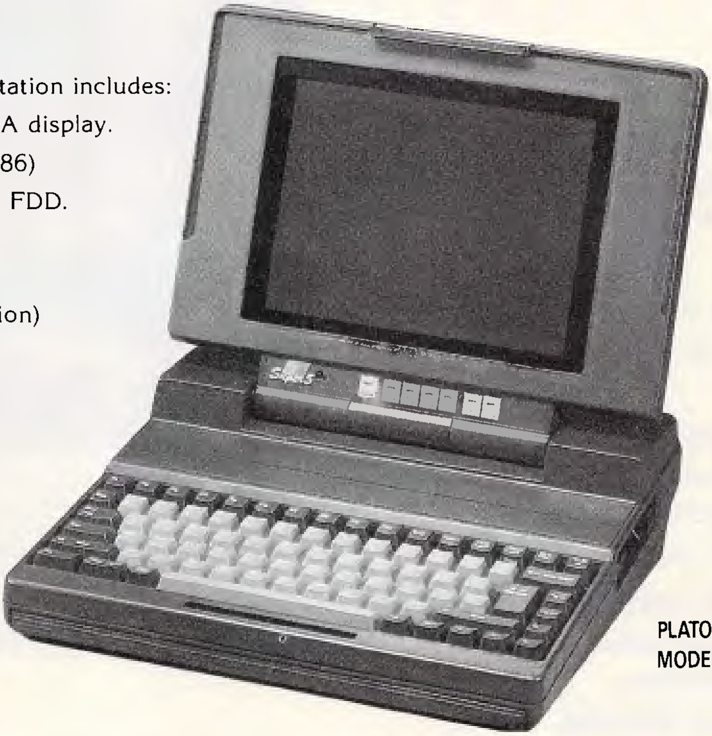
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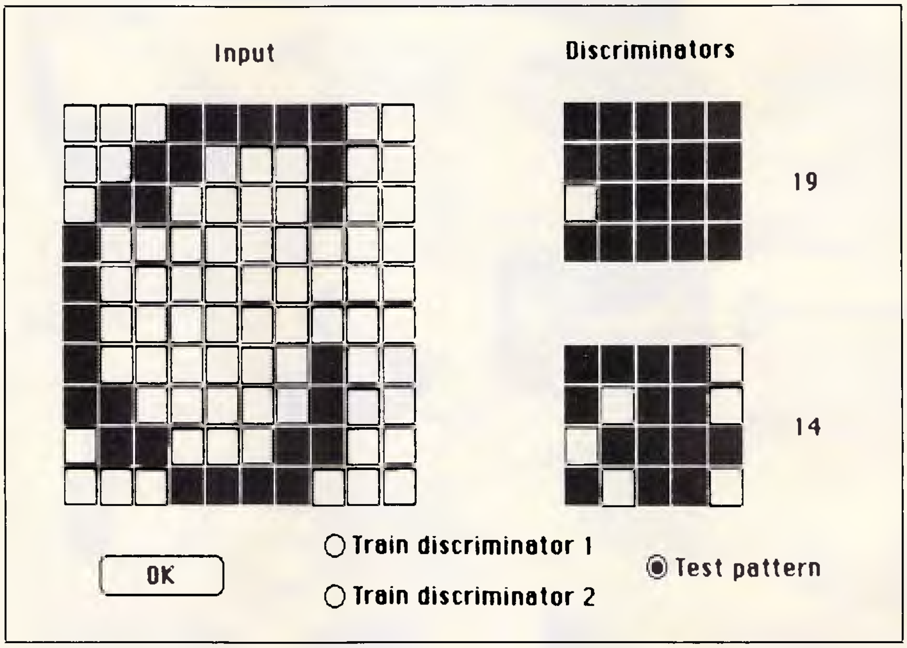

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Like most fashion trends, this one has its roots in the distant past. In 1943, before the first real computers had been built, an 18-year-old prodigy called Walter Pitts teamed up with Warren McCulloch, a neurophysiologist at the University of Illinois, to write a paper called *A Logical Calculus Of The Ideas Imminent In Nervous Activity.* It proposed an explanation of how brain cells could operate as digital on/off devices.

As it turned out, McCulloch and Pitts got it wrong. Their explanation was far too simplistic, but it marked the beginning of a stormy marriage between brains and computers that has remained fruitful. At times the brain has been seen as a living computer, at other times computers have been explained as electronic brains. Often the link between them has been fiercely denied. Yet today it seems that some of the most important work in understanding how the brain operates is based on ideas borrowed from computing, while the most exciting developments in computing are using the sorts of structures, called neural networks, which occur in the brain.

Distributed processing

Examined under the microscope, both brains and computers are made up of vast numbers of simple elements connected together in highly complex patterns. In the case of computers these building blocks are logic gates and memory circuits. In the brain, they are neurons — brain cells which in some respects operate rather like gates.

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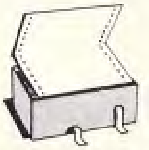

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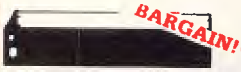


PRINTER RIBBONS TO SUIT:

CP80, SX80, DP80, BX100, MB100
1-9 (C22036) 10+
$8.95 **$7.95**

MX70 MX80 FX70 FX80 RX70 RX80
1-9 (C22031) 10+
$8.95 **$7.95**

MX100, FX100, RX100
1-9 (C22002) 10+
$19.95 **$18.95**

LX80
1-9 (C22003) 10+
$19.95 **$18.95**

LQ1000
1-9 (C22012) 10+
$27.60 **$25.00**

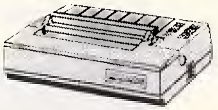
RS232 BREAK OUT BOX

A simple way of monitoring RS232 interface lead activity. Interface powered, pocket size for circuit testing, monitoring and patching. 10 signal powered LED's and 2 spares. 24 switches enables you to break out circuits or reconfigure and patch any or all the 24 active positions.

SPECIFICATIONS:
Connectors: DB25 plug on 80mm ribbon cable and DB25 socket.
Indicators: Tricolour LED's for TD, RD, RTS, CTS, DSR, CD, TC, RC, DTR, (E)TC.
Jumper Wires: 20 tinned end pieces.
Power: Interface power.
Enclosure: Black, high impact plastic.
Dimensions: 85 x 95 x 30mm

X15700 **$94.95**

GET MORE FOR YOUR DOLLAR WITH ROD IRVING ELECTRONICS!



CANON A-50 PRINTER

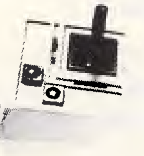
- Serial Impact Dot Matrix
- 180 C.P.S
- Near Letter Qualify Mode
- 1.4K Buffer

Cat. C20045 **$595**

PANASONIC KX-P1081 DOT MATRIX PRINTER

- 120 C.P.S.
- Pica or Elite character set
- Print Modes: NLQ, Dot Graphics, Proportional Font, Draft.
- Proportional Printing
- Reliable and Compact
- Proportional Printing
- Logic Seeking
- 1K Printer Buffer

Cat. C20035 **only $595**



JOYSTICK FOR IBM

Features Selectable "Spring centering" or "free floating". Electrical trim adjustments on both axis. 360 degree cursor control

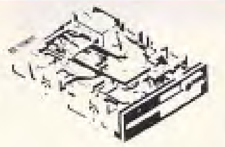
Cat. C14205 **$39.95**

APPLE* COMPATIBLE SLIMLINE DISK DRIVE

Compatible with Apple 2+
Cat. X19901 .... Normally $225
SPECIAL $179

APPLE* IIC COMPATIBLE DISK DRIVE

(including cable **only $199**



NEC DISK DRIVES

3½" DISK DRIVE

- 1 M/Byte unformatted. (640K formatted).
- Double sided, double density.
- Access Time 3m/sec

Cat. **$255**

5¼" SLIMLINE

- Switchable 1.6 M/Byte to 1 M/Byte unformatted
  1.2 M/Byte to 720K formatted
- Double sided, double density.
- AT compatible

Cat. C11906 **$269**

8" SLIMLINE

- Double sided, double density.
- 1.6 M/Byte unformatted.

Cat. C11908 **$785**

PRINTER STANDS

- Restores order to your work area.
- Conveniently stacks paper printout in document tray automatically
- Made of black plastic coated steel
- Suitable for most printers
- Excellent value at these pricas!

C21054 (80 column) **$26.95**
C21056 (132 column) **$36.95**

DELUXE PRINTER STAND

- Restores order to your work area without occupying extra space.
- Feeds and refolds paper under the printer automatically.
- Adjustable paper deflectors ensure smooth flow of paper.
- Made of moulded plastic
- Suitable for most printers

C21058 (80 column) **$69.95**

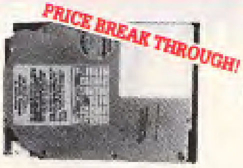
THE BUTTON SPIKE PROTECTOR

Surges and spikes are caused not only by lightning strikes and load switching but also by other equipment being switched on and off, such as fluorescent lights, electric motors, fridge freezers, air conditioners, etc.

For effective protection such spikes must be stopped before they reach your equipment. Simply plug The Button into an outlet and it will protect all equipment plugged into adjacent outlets on the same branch circuit. The Button employs unique metal oxide varister technology and will dissipate 150 joules of electrical energy. (nearly twice that of comparable surge arresters.)

SPECIFICATIONS:
Voltage: 240V Nominal
Total Energy Rating: 150 joules
Response Time: 10ns
Protection Level: 350V peak

$34.95



20 M/BYTE HARD DISK

Tandon drive with controller card. IBM* compatible. Warranty.

Cat.X20010 **ONLY $595**

40 M/BYTE HARD DISK

Seagate drive, IBM* compatible 12 month warranty.

Cat. X20020 **ONLY $795**

80 M/BYTE HARD DISK

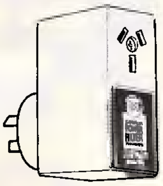
Seagate drive, IBM* compatible 12 month warranty.

Cat. X20030 **ONLY $2,695**

3½" EXTERNAL DRIVE

- 720K formatted capacity.
- 37 way D type connector fits directly onto drive controller card.
- Compatible with IBM* PC/XT.
- Requires DOS 3·2 or greater.
- Size: 266(D) x 104(W) x 75(H)mm

only $395



CPF CONTINUOUS POWER FILTER SPIKE ARRESTOR

The Fortron CPF Filtered Electronic Spike Protector provides a protective electronic barrier for microcomputers, printers, telephone systems and modems electronic typewriters, audio and stereo systems and other sensitive electronic equipment.

The CPF provides protaction from dangerous electrical spikes that can cause anything from obvious damage (like immediate equipment failure) to less obvious harm that can drastically shorten a system's life.

CPF's superior circuitry design and semi conductor technology responds instantly to any potentially damaging over-voltage, ensuring safe trouble free operation.

Additionally, CPF's filtering capability helps eliminate troublesome and annoying interference, general hash created by small motors, fluorescent lamps, and the like that threaten the performance and shorten equipment life of unprotected electronic components.

SPECIFICATIONS:
Electrical rating: 220-260 volts (AC) 50Hz 10 Amp
Spike/RFI Protection: 4,500 amps for 20m/second pulses.
Maximum clamping voltage: 275V differential mode.

Cat.X10088 **$69.95**

SCHMIDT 123AT MULTI STANDARD MODEM

- V21, V22, V23 Multi standard modem (300/300, 1200/1200, 1200/75)
- Auto dial "AT" command set (Hayes* compatible)
- Auto answer auto disconnect
- Auto answerback (Similar to Telex)
- Auto or manual control
- Dial-up or leased line operation
- Pulse or Tone Dialing
- Automatic speed ranging
- Speaker for call progress monitoring
- Baud-rate converter with 48 character buffer (V23)
- Synchronous or asynchronous operation
- Fully self contained power supply
- Low power operation
- Metal case (R.F. shielded)
- Visual monitoring of important interface circuits (7 LED's)
- Full or half duplex (V23)
- Double adaptor plug to allow use of standard phone (Mode 1·3/5)
- Telecom Authorised (C87 37/65)

$595

*Hayes is a trademark of Hayes Microcomputer Products Inc

3½" DISK STORAGE (DD80-L)

- Holds up to 80 x 3½" diskettes.
- Smoked plastic hinged lid
- Lockable (2 keys supplied)
- High impact plastic base
- Contemporary design

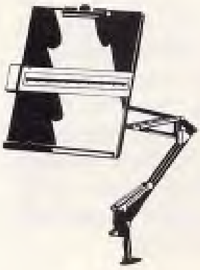
Cat. C16038 **only $19.95**

MAIL ORDER HOTLINE
008 335757
(TOLL FREE)
LOCAL: 543 7877

COPY HOLDER (YU-H33)

- Copy area 9½" x 11"
- Sliding line guide
- Flat metal base

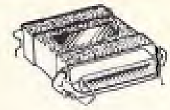
C21060 **$39.95**



COPY HOLDER (YU-H32)

- Adjustable arms allows easy positioning.
- Copy area 9½" x 11"
- Sliding line guide
- Clamp mounting

C21062 **$39.95**

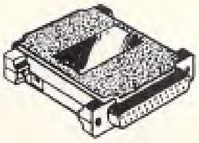


CENTRONICS GENDER CHANGERS

- Female to Female
- Saves modifying or replacing non-mating Centronics cables.
- All 36 pins wired straight through.

Cat. X15663 **Male to Male**
Cat. X15661 **Male to Female**
Cat. X15664 **Female to Female**

Normally $33.95.
Only $24.95

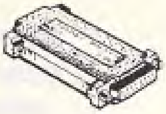


RS232 GENDER CHANGERS

- Saves modifying or replacing non-mating RS232 cables.
- All 25 pins wired straight through

Cat. X15650 **Male to Male**
Cat. X15651 **Male to Female**
Cat. X15652 **Female to Female**

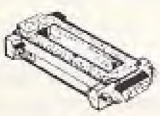
Normally $14.95 each
Only $9.95



DB15 GENDER CHANGERS

- Saves modifying or replacing non mating DB15 connections
- All 15 pins wired straight through

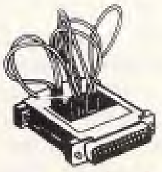
X15645: Male to male
X15646: Male to Female
X15647: Female to Female
only $14.95



DB9 GENDER CHANGERS

- Saves modifying or replacing non mating DB9 connections
- All 9 pins wired straight through

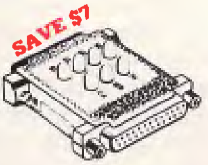
X15640: Male to male
X15641: Male to Female
X15642: Female to Female
only $14.95



RS232 WIRING ADAPTOR BOX

- Male to female
- 25 Detachable plug on leads
- 2 mini jumpers
- Ideal for experimenting or temporary connections

Cat. X15665 **Normally $49.95**
Only $44.95



RS232 MINI TESTER

- Male to female connections
- All pin wired straight through
- Dual colour LED indicates activity and direction on 7 lines
- No batteries or power required

T.D. Transmit Data
D.S.R. Data Set Ready
R.D. Receive Data
C.D. Carrier Detect
R.T.S. Request to Send
D.T.R. Data Terminal Raady
C.T.S. Clear to Sand

Cat. X15656 ...... **Normally $39.95**
SPECIAL, ONLY $32.95

SAMSUNG 12" FLAT SCREEN COMPOSITE MONITOR ONLY $149

FEATURES....
- Flat, high contrast, non-glare screen
- High resolution, 80 or 40 character display
- Tilt/swivel base
- Compatible with Apple* and IBM* colour composite signal

SPECIFICATIONS....
Picture tube: 12" diagonal and 90° deflection
Phosphor: Available in Green or Amber
Video input signal: Composite Signal
Polarity: Negative Sync
Level: 0·5-2·0Vp-p
Impedance: 75ohm
Scanning frequency:
Horizontal: 15.734 KHz + − 0·1%
Vertical: 50-60Hz
Video bandwidth: 20MHz
Active display area:
216(H) x 160(V)mm.
Display character:
80 character x 24 rows.
Input terminal: RCA Phono Jack.
Controls:
Outside: Power Switch, Contrast, Brightness, H-Shift, V-Size.
Inside: H-Width, H/V hold, H/V linearity, Focus.
Power supply: 110/120V 60Hz. 220/240V 50Hz
Dimensions:
310(W) x 307(H) x 300(L)mm
Weight: 8·1 Kg
Shipping weight: 9·6 Kg

Cat.No.	Description	Price
X14510	GREEN	**only $149**
X14512	AMBER	**only $149**

RITRON 2 MONITORS

Stylish monitors available in green or amber displays and featuring swivel base that tilts forward and back 30 degrees and swivels right to left 60 degrees!

SPECIFICATIONS:
CRT DISPLAY SIZE: 12 inches non-glare 90 degree deflection.
INPUT SIGNAL: 1.0 - 2.5V p-p composite video signal.
INPUT INPEDANCE: Normal 75 ohm, high approx. 50K ohm.
INPUT TERMINALS: RCA phone jack.
RISE AND FALL TIME: Less than 25 us
VIDEO BANDWIDTH: 20MHz
Corner; 800 lines
Geometric distortion; 2% or less
Linearity; less than 2%
CONTROLS: Front; Power On/Off, brightness, contrast
Rear; Vertical hold, Horizontal hold, Vertical line, Vertical size.

Green Cat. X14506..**Normally $235**
Amber Cat. X14508..Normally $239
NOW ONLY $169

THOMSON EGA MONITOR

Top quality high resolution EGA monitors with a space-age design.

SPECIFICATIONS:
CRT: 14 inch (360mm) diagonal, 90 degree deflection.
Display Size: 245(H) x 180(V)mm
Phosphor: P22, non glare, tinted screen.
Dot Pitch: 0.31mm
Video Bandwidth: 18 MHz
Resolution: 15·75KHz - 640 x 200
21·85KHz 640 x 350
Input Signals:
1. RGBI - positive, H(+), V(+)
2. RrGgBbI - positive, H(+), V(−)
Input Impedance: TTL Level (330 ohms)
Dual Scanning Frequency:
Horizontal: 15·75 KHz or 21·85 KHz + − 10Hz
Vertical: 50 - 60 Hz
Connector: 9 pin, D-type
Size: 312(H) x 363(L) x 380(W)mm
Weight: 10·8 Kg (Net)
X14525 .... **$895**

MONITORS $129

SAMSUNG TTL 12" MONITOR

- High contrast, non-glare screen
- Excellent value for money!

SPECIFICATIONS:
Picture tube: 12" diagonal 90° deflection
Mode: TTL
TTL input signal:
Polarity: TTL Positive
Level: 4V p-p + − 1·5V
Impedance: 75ohm
Video bandwidth: 16MHz (3dB)
Scanning frequency:
Horizontal: 18·432 + 0·1KHz
Vertical: 50HZ + − 0·5%
Active display area:
216(H) x 160(V)mm
Display characters:
80 characters x 25 lines
Input connector: 9 pin connector
Controls:
Front; Power ON/OFF, Contrast.
Rear; V-Hold, V-Size, Brightness
Internal; Vertical Linearity, Horizontal Linearity, Horizontal Width, Focus.
Power supply: 110/120V 60Hz. 220/240V 50 Hz
Dimensions:
308(W) x 297(H) x 307(L)mm
Weight: 7·3Kg
Shipping weight: 8·3Kg

Cat.No.	Description	Price
X14500	(GREEN)	**$189**
X14502	(AMBER)	**$189**

HEAD CLEANER DISKS

It only takes a minute amount of dust, dirt or magnetic oxide particles on your drive heads to cause problems: errors, downtime or an expensive service call. Regular use of a head cleaner will keep your drive free of trouble causing dirt and help keep your system up and running. These disk cleaners are simple to use, and include cleaning solution and instructions.

CAT.No.	SIZE	PRICE
C12560	3½"	$6.95
C12555	5¼"	$6.95

SAMSUNG 12" 20MHz COMPOSITE MONITOR ONLY $129

FEATURES....
- High contrast, non-glare screen
- High resolution, 80 or 40 character display

SPECIFICATIONS....
Picture tube: 12" diagonal and 90° deflection
Phosphor: Available in Green (P39) or Amber
Video input signal: Composite Signal
Polarity: Negative Sync.
Level: 0·5V-2·0Vp-p
Scanning frequency:
Horizontal: 15.734 KHz + 0·1%
Vertical: 60Hz
Video bandwidth: 20MHz
Active display area:
216(H) x 160(V)mm.
Display character:
80 characters x 25 rows.
Input terminal: RCA Phono Jack
Controls:
Outside: Power Switch, Contrast, Brightness, H-Shift, V-Size.
Inside: H-Width, H/V hold, H/V linearity, Focus.
Power supply: 110/120V 60Hz. 220/240V 50Hz
Dimensions:
308(W) x 307(H) x 297(L)mm
Weight: 7·3 Kg
Shipping weight: 8·3 Kg

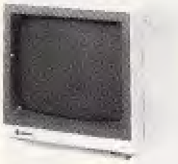
Cat.No.	Description	Price
X14514	(GREEN)	**$129**
X14516	(AMBER)	**$129**

10 OR MORE ONLY $119^ea^

SAKATA 13" RGB COLOUR MONITOR

High quality IBM* compatible monitors, great with VCR's too!

SPECIFICATIONS:
CRT: 13", 90° deflection colour
Input Signal:
Video Signal: Separate video signal
Video: Positive
Sync.: Positive
Input Level: TTL Level
Scanning Frequency:
Horizontal: 15.7KHz
Vertical: 60Hz
Display Size: 245(H) x 182(V)mm
Resolution:
Horizontal: 640 dots
Vertical: 200 lines
Size: 343(H) x 362(W) x 421(D)mm
Weight: 11.6kg
Cat. X14530 .... **$695**



SAMSUNG 12" TTL/COMPOSITE MONITOR ONLY $179

FEATURES....
- At last a monitor with both TTL and Composite modes!
- High contrast, non-glare screen
- High resolution, 80 or 40 character display
- Swivel/Tilt base

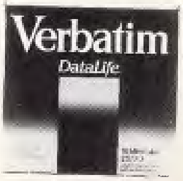
SPECIFICATIONS....
Picture tube: 12" diagonal and 90° deflection
Phosphor: Green (P42)
Video input signal: Composite/TTL Switchable
Polarity: Negative/Positive
Level: 0·5 - 2·0Vp-p/4·0 + - 1·5Vp-p
Impedance: 75ohm, more than 6·8K ohm
Scanning frequency:
Horizontal: 15.75 KHz + − 0·1%/18·432KHz + - 0·1%
Vertical: 47-63Hz
Video bandwidth: 20MHz
Active display area:
Composite: 206(H) x 160(V)mm.
TTL: 216(H) x 160(V)mm
Display character:
80 characters x 25 rows.
Input terminal: Phono Pin Jack, 9 pin D-Sub Connector.
Controls:
Outside: Power Switch, Contrast, Brightness, Signal Select, V-Hold, V-Size.
Inside: H-Width, H/V linearity, Focus, H/V-Shift.
Power supply: 110/120V 60Hz. 220/240V 50Hz
Dimensions:
308(W) x 297(H) x 307(L)mm
Weight: 7·3 Kg
Shipping weight: 8·3 Kg

Cat.No.	Description	Price
X14509	(GREEN)	**$179**

ANTI GLARE SCREEN

Half the price of other brands!!
Relieve eye strain and headaches and increase productivity with these Anti Glare Screens. Suitable for 12" monochrome.
Cat X99995 .... **$24.95**

CHEAP DISKS



VERBATIM DISK SPECIALS!

All prices 10 disk boxes!

Description	1-9 boxes	10+boxes
3½" 1S/2D	$44.95	$42.95
3½" 2S/2D	$46.95	$43.95
5¼" 1S/2D	$22.00	$21.00
5¼" 2S/2D	$26.00	$24.00
5¼" 2S/4D	$75.00	$70.00
5¼" 2S/HD	$42.95	$41.00

"NO BRAND" DISKS!!

Now you can buy absolute top quality disks that are also the cheapest in Australia! They even come with a 5 year guarantee, which indicates the quality of these disks. So why pay 2-3 times the price for the same quality?

Packs of 10, D/S D/D without boxes, or brand name, just their white paper jacket, and index labels. (5¼" disks includes write protects).

5¼" D/S "NO BRAND" DISKS FROM $0.80 EACH!!

10+DISKS	100+DISKS	1,000+DISKS
$9·00^ea^	$8·50^ea^	$8·00^ea^

(ALL PRICES PER 10 DISKS. TAX EXEMPT PRICES LESS $1)

3½" D/S D/D "NO BRAND" DISKS!

10+DISKS	100+DISKS	1,000+DISKS
$27	$26	$24

(ALL PRICES PER 10 DISKS. TAX EXEMPT PRICES LESS $4)

MICRODOT DISKS!

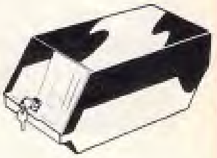
DESCRIPTION	1-9 BOXES	10+ BOXES
3½" 2S/2D	$29.95	$28.95
5¼" 1S/2D	$12.95	$11.95
5¼" 2S/2D	$13.95	$12.95

(SEND $2 FOR SAMPLE DISK!)

5¼" DISK STORAGE (DD50-L)

Efficient and practical. Protect your disks from being damaged or lost!
Features...
- 50 x 5¼" disk capacity
- Smoked plastic hinged lid
- Lockable (2 keys supplied)
- Contemporary Design

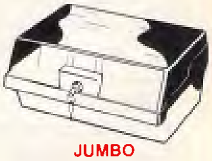
Cat. C16025 .... **only $14.95**



5¼" DISK STORAGE (DD100-L)

Efficient and practical. Protect your disks from being damaged or lost!
Features...
- 100 x 5¼" disk capacity
- Smoked plastic hinged lid
- Lockable (2 keys supplied)
- High impact ABS plastic base.
- Contemporary design

C16020 .... **only $17.95**



JUMBO 5¼" DISK STORAGE (DD120-L)

If you have lots of disks, you'll appreciate the extra capacity of this disk storage unit when it comes to locating a particular disk.
Features...
- 120 x 5¼" disk capacity
- Smoked plastic hinged lid
- Lockable (2 keys supplied)
- High impact plastic base

C16028 .... **only $22.95**

rie

Rod Irving Electronics

MELBOURNE: 48 A'Beckett St.
Phone (03) 663 6151

NORTHCOTE: 425 High St.
Phone (03) 489 8866

CLAYTON: 56 Renver Rd.
Phone (03) 543 7877

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P.O. Box 620, CLAYTON 3168
Telex: AA 151938
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POSTAGE RATES:

$1	$9.99	$2.00
$10	$24.99	$3.00
$25	$49.99	$4.00
$50	$99.99	$5.00
$100	$199	$7.50
$200	$499	$10.00
$500 plus		$12.50

The above postage rates are for basic postage only. Road Freight, bulky and fragile items will be charged at different rates.

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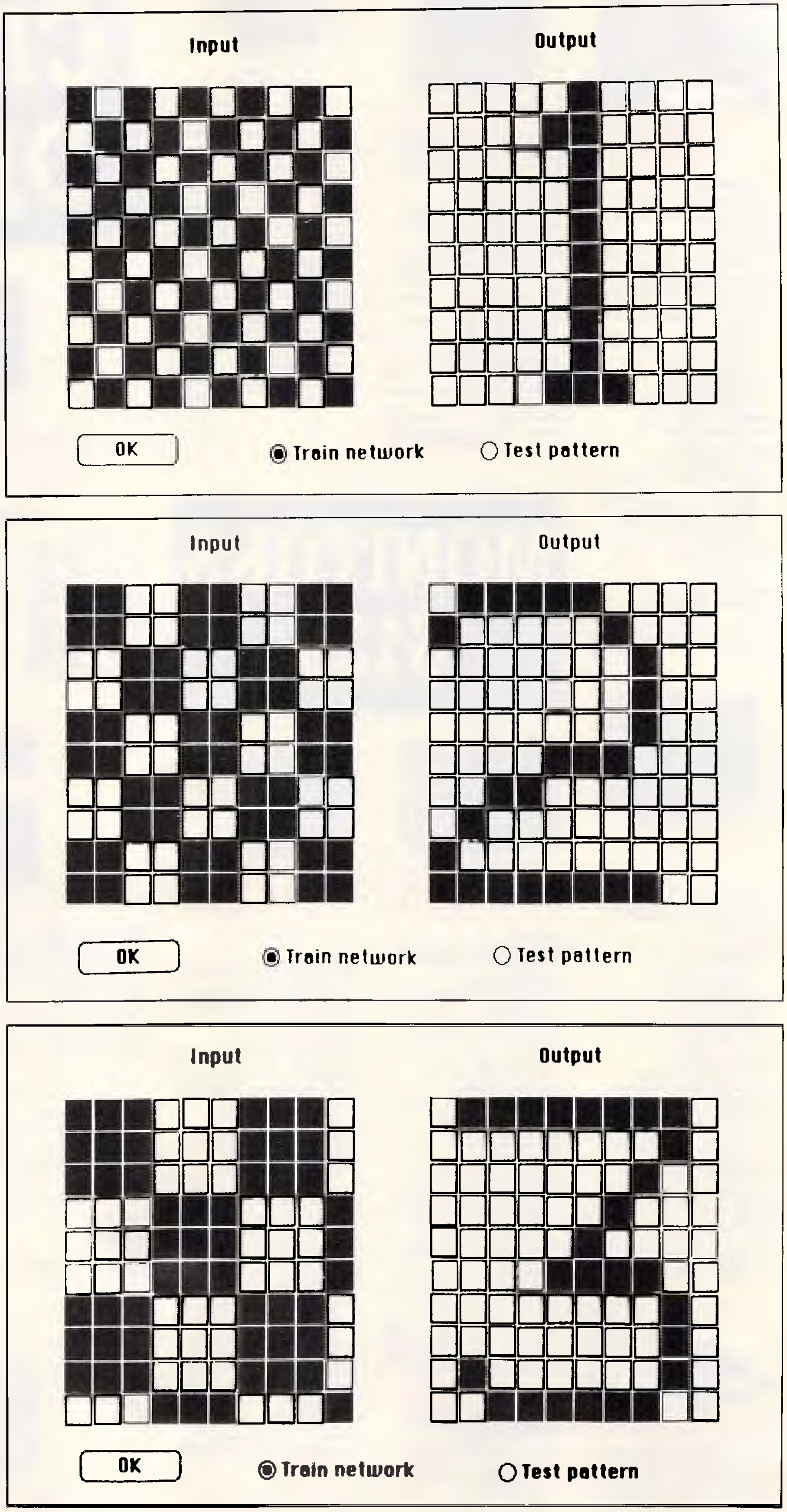
output is likely to be quite complex. What makes this so different from the circuitry of conventional computers is not so much the basic elements involved, because they can be modelled with logic gates, but rather the way that the various elements are linked together.

The pathways, finely etched into silicon chips or printed circuit boards, are the outcome of a deliberate design process so that each one has a precise purpose. Alter any one and that particular purpose will no longer be served — in some specific way the computer will now be faulty. But alter any link in a neural network and all that is likely to happen is that it will tend to be less reliable, occasionally producing incorrect answers or perhaps becoming less able to cope with incomplete data. It's a subtle distinction but an important one, and it arises because of the unusual way that neural networks process information.

Conventional computers follow a standard design called the von Neumann architecture. This consists of a central processing unit and an extensive addressable memory, the two being joined together by a data bus. To speed things up, modern parallel processing machines make use of several, or even very many, processors, with some way of dividing up the task between them and with an overall control system to prevent conflicts. Neural networks go far beyond even these parallel machines to a style of operation called distributed processing in which all the activities are mixed up and spread out throughout the whole network. Whereas, in an ordinary computer, one group of gates may be wired together as a shift register, another group as an adding circuit; in a neural network, any region looks and operates like any other.

The implications of this distributed approach are significant. For a start, there's the ability (already mentioned) of being able to cope gracefully with faults. That's something that we have cause to be grateful for — an adult brain loses a great many brain cells every day, yet all that we experience is a very gradual decline in our capabilities. Then there is the ability to handle incomplete or corrupted information. The brain is very good at recognising a familiar face from just a fuzzy photograph or understanding speech in a noisy room; so too, artificial neural networks can grasp connections from partial data. The third important ability is that of learning from experience. This is clearly something at which the brain excels, but it is very difficult to program into a computer;



● Train network ○ Test pattern

● Train network ○ Test pattern

● Train network ○ Test pattern

Three chequerboard patterns stored simultaneously in the Associative Memory with their linked output (see the 'Program information' box)

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neural nets do it naturally — indeed, a neural network cannot be programmed to perform a task, only trained by example. This arises out of another characteristic of neural networks: they are self-organising, able to settle into a stable and meaningful state without requiring the details to be specified. Indeed, we need not know the internal state of a network and, anyway, we could not discover it just by observing its outward behaviour.

There is no evidence to suggest that any electronic neural networks are replicas of the living neural networks in our brains, but they do seem to follow the same general principles and exhibit similar qualities. How close the analogies really are is a matter of great scientific debate at present, but, whatever the outcome of that, there is no doubt that neural networks are starting to have a profound effect on computing. In areas as diverse as robot vision; natural language understanding, the travelling salesman problem and handwriting recognition, neural networks are the fashionable line of research. What is so intriguing is that they have been around almost since the days of McCulloch and Pitts but fell from grace catastrophically and, until recently, were so thoroughly unfashionable that few people would admit to working with them.

Neural fashions

A dominant figure in this whole field is Norbert Wiener, a mathematical genius who, in 1947, wrote a book called *Cybernetics* and, in the process, created the science of the same name. Among other things, Wiener proposed that the way the brain is built may determine the way that it works and suggested that it might be worthwhile, in trying to understand the brain, to build machines that resemble it.

Forty years on, it looks as if this is going to prove a very prophetic idea; cybernetics has rather faded from prominence but much of cognitive

Program information

The programs which appear in 'Program File', at the end of this article, are designed to demonstrate how a conventional microcomputer can simulate parallel distributed processing by a neural network. Written in Microsoft Basic version 3.0 for the Apple Macintosh, they make extensive use of the Mac's graphical capabilities and mouse, but could easily be adapted for other machines and other user interfaces. They also provide a base from which to delve into more complex neural networks.

Although the two nets are different in their layout and operation, they share many features. Both consist of simple, binary McCulloch-Pitts neurons which are either firing or not. The neurons appear onscreen as small squares — white if the cell's output is zero, black if it is one; with layers of neurons arranged as blocks, so that patterns of cell activity can be visualised graphically.

The method of entering patterns into the neuron layers is based on the FatBits technique used in MacPaint. Pressing the mouse button on a cell changes its value (0→1, 1→0) and the pointer will then paint this new value onto any other squares that it is dragged over. The Toolbox routines 'SetRect' 'PtInRect' and 'PtInRects' are used to test whether the pointer is within a block, and then calculation is used to find the specific cell that it is on. The volume name 'MyDisk', which appears in both programs, must be changed to the actual location of the NetLib file containing Toolbox routines.

Both nets need to be trained before they can be used and buttons are provided to select training or testing functions. A pull-down menu offers the choice of quitting the program or restarting with a new net of the same type; on some machines it may be necessary to use cursor keys to move around and set individual neurons, while function keys could replace screen buttons and menus.

The associative memory

How do we remember the date of Australia Day or the shape of a cat? Nobody knows, but what is certain is that we don't do it by filing the information away at specific memory locations — human memory appears to be distributed within networks of brain cells. Whereas extracting data from a computer requires that we should know exactly where to look, human memories are often brought out simply by association.

This network demonstrates one way that a simple distributed associative memory can be created. It has two layers of neurons arranged in a symmetrical, bi-directional, fully-connected network. Fully-connected, because every neuron in the first layer is connected to every neuron in the second; bi-directional, because the outputs of each layer feed back to the inputs of the other; and symmetrical, because the connection weight between any two units is the same in both directions. Several pairs of patterns can be stored simultaneously within the network, and entering any one of them will recall its associated memory in the opposite layer.

Initially, the program asks for the extent of input and output layers; both are arranged as square blocks, so entering '8', for example, will result in a layer of 64 neurons. The two layers need not be the same size. To train the net, select 'Train Network' and use the mouse to enter a pattern in each layer. Pressing the 'OK' button calculates the connection weight needed to associate these two patterns and stores them in the array c%(99,99).

This is a very simple calculation. Each neuron has an output of 0 or 1, and the outputs for the two layers are stored in a%(99) and b%(99). To find the connection weight between the i^{th} unit in the first layer and the j^{th} unit in the second, convert their 0 or 1 values to −1 or 1 and multiply to give c%(i,j). Training on subsequent pairs of patterns simply involves repeating this process and adding the results to the weights already stored in the connection array. This is all done in the 'Matrix' subroutine by the line:

```
c%(i%,j%) = c%(i%,j%) + ((a%(i%)*2-1)*(b%(j%)*2-1)).
```

Further patterns may be added at any time; the number that can be stored simultaneously in the net depends very much on the actual patterns, but three separate pairs should usually be possible and, in some cases, five pairs or even more may co-exist. Once trained, the net can be used by selecting Test Pattern and painting a pattern onto either layer of neurons. Press OK and, if it can, the net will respond by recalling the associated pattern in the other layer and then correcting any errors in the input pattern. Simple chequerboards offer a very good demonstration of the network's abilities as even very fragmentary portions should be correctly identified. Some patterns are more difficult and the net may show quite complex behaviour, perhaps combining a couple of patterns if it cannot decide between them; or, sometimes, finding the pattern most unlike what it sees and negating it.

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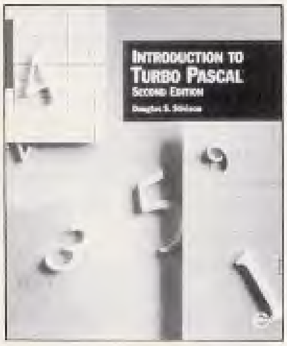

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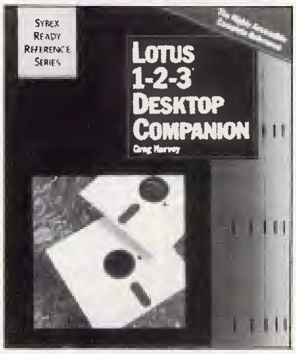

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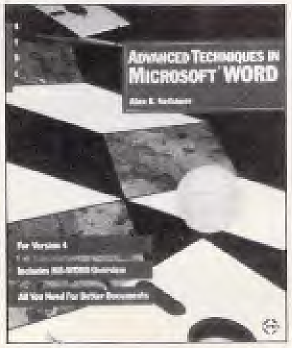

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science rests on this proposal. At the time it was simply not practicable to put Wiener's suggestion to the test. The then current technology of valves and electromagnetic relays was simply too large and power-hungry to build any but the smallest of neural machines.

Nevertheless, in 1952, a British psychologist, W Ross Ashby, was able in all seriousness to write a book called *Design For A Brain*. It's hardly a DIY guide for budding Frankensteins, the limit of its practical aims being an ingenious construction called the Homeostat, which is made up of electronic valves, telephone exchange switch-gear and troughs of water. It was intended to demonstrate what Ross Ashby called 'ultrastability' — the tendency found in living creatures to adapt to environmental changes so that some desired state could be maintained even when external influences tended to work against it. An analogue device, the Homeostat owed nothing whatsoever to the new digital computers that were developing so rapidly at the time, but it was a forerunner of attempts to build brain-like machines.

In fact, the development of computers and the study of neural networks followed strictly separate paths throughout the 1950s. The rapid progress being achieved in computing did not encourage its developers to get involved in the seemingly impossible task of constructing an artificial neural net. A number of large electro-mechanical and even electro-chemical machines were built in the early 1960s, but nobody in their wildest dreams could envisage such cumbersome creations ever being useful for real information processing. Ironically, it was the increasing power of digital computers that came to the rescue of neural nets when it became apparent that, rather than build networks, it would be much easier to simulate them in computer software.

Naturally, simulating a vastly parallel system inside a serial computer takes

These results are produced by the subroutine 'Compute' Each neuron takes an input from every neuron in the other layer, so we need two nested loops to calculate a whole layer. Taking the essential features of neuron in turn: 'Input' comes from every neuron in the other layer and is held in a%( ) or b%( ); the 'connection weight' (which may be positive or negative) for any two cells is held in c%(,). It must be multiplied by the input value; 'Summation' of all these weighted inputs is built up in s%; and the 'threshold' for the cell to fire is zero. If s% is less than zero, the neuron will not fire (output=0). If it is greater, then it will fire (output=1). If it is equal to zero, then the output is left as it is.

The subroutine goes through this whole process to calculate every neuron in the second layer, and then again for the reverse flow of excitation back to the first layer. As the new output of each cell is calculated, it is compared to the old value and then displayed. The differences are totalled in diff% and the network is recalculated until diff%= 0, indicating that both layers have stabilised.

Discriminator

The discriminator is a small simulation of the WISARD robot vision system; it offers impressive pattern recognition from a very simple single-layer network. The program creates a 10x10 block of input cells, on to which a pattern can be painted with the mouse, and two discriminator blocks which score its similarity to previously-trained patterns.

The idea behind it is very simple: we take a random group of five units from the input layer and assign to each of them one bit in a five-bit binary word. If the cell is on, then its bit is set to one, otherwise to zero. Clearly, every possible combination of on and off among the five inputs produces its own unique binary number — the whole pattern can be stored in 20 such numbers. In order to train the net to discriminate between two patterns, we simply enter them both and store the two sets of numbers that result. Any subsequent patterns can then be tested by comparing their numbers to those stored.

This comparison is displayed in the two discriminator blocks. For every one of the 20 random groups of input cells, there is one unit in each of the discriminators. If the number produced by that grouping matches the value for either of the two training patterns, then the appropriate discriminator cell turns on (there may be elements common to both patterns which will, therefore, affect both discriminators). Finally a score of the number of units matched in each discriminator shows which of the two training patterns was closest to the test pattern.

There are, of course, easier ways of comparing two patterns. But what we want is a system that can generalise by detecting, for example, the similarity between all letter 'c's and differentiating them from all letter 'o's. This is achieved by training the net on up to five examples of each type of pattern and storing all the sets of numbers produced. When a new test pattern is applied, each cell in the two discriminator blocks acts as an OR gate, showing if at least one of its training examples matches the present value of the group. This gives the system remarkable abilities: training one discriminator on five different hand-drawn 'c's and the other on five 'o's will let it correctly identify almost any other example of the two letters.

The program begins by creating a display screen and building up the random connections, which are different every time. The array b%(19,4) holds a list of the five input cells that each of the 20 discriminator units is connected to. In order to train the net, select 'Train discriminator 1' or 'Train discriminator 2' so as to allocate the pattern to one or other type, then paint it in. Pressing OK stores the values of all input cells in the array a%(100).

The 20 numbers that define this training pattern are produced by the subroutine 'Matrix' and stored in the arrays b1%(19,4) or b2%(19,4) according to which discriminator was selected (the second dimension allows for five examples for each). The effect of setting individual bits in a five-bit word is achieved by multiplying each input value by its corresponding power of two.

When all the examples have been entered press 'Test pattern' and paint a pattern onto the input layer. Pressing OK directs the program to the subroutine 'Compute' which calculates the value of each group and compares it to all the corresponding stored values. If any of them match, the appropriate discriminator cell is switched on and that discriminator's score is increased by one.

Apart from using it to recognise individual letters, another good demonstration is provided by training one discriminator on five vertical bars, each two cells wide, and the other on five horizontal bars. They will then identify very effectively whether any roughly-scrawled line is more nearly vertical or horizontal. It's an ability that forms an important part of the brain's visual processing.

Everything happens in a single pass so the discriminator is very fast and, unlike most neural networks, provides its response in a fixed, predictable time. Because its individual units are so simple, it is really just on the borderline of neural networks, but it does demonstrate some of the enormous potential of the connective approach.

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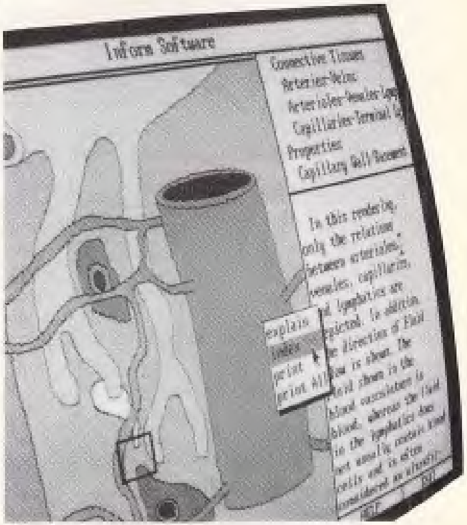

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M1078: WORLD GENERATOR FOR GAMES. Produces solar systems for science-fiction role-playing games. Generates, edits, stores systems and maps.

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```
          '   Neural Network Associative Memory
          '   © Jack Weber - November 1987

          '   Constructs fully connected bidirectional associative memory
          '     Variable size neuron layers
          '     Iterates until stable
          '     Visual input/output
          '   ------------------------------------------------------------------
          '     Runs on Apple Macintosh under MS Basic v3.0 with Toolbox Library
          '   ------------------------------------------------------------------

ON BREAK GOSUB Quit
GOSUB Initialise
net:
GOSUB Parameters
GOSUB Display
loop:
GOSUB Pattern
FOR i% = 2 TO 3
   state% = BUTTON(i%)
   IF state% = 2 THEN choice% = i%-1
NEXT
ON choice% GOSUB Matrix, Compute
GOTO loop
END
            ------------------------------------------------------------------



  Change to wristwatch cursor while clearing connections
  ChangeCursor 4
  FOR i% = 0 TO insize%*insize%-1
     FOR j% = 0 TO outsize%*outsize%-1
        c%(i%,j%) = 0
     NEXT
  NEXT
  Restore default cursor
  CALL INITCURSOR
RETURN

Display:
  Draw both layers of neurons with all units set to zero
  CALL TEXTFONT(0)
  CALL MOVETO(110,25)
  PRINT "Input"
  CALL MOVETO(352,25)
  PRINT "Output"
  xin% = 115 - (insize%-1)*10
  yin% = 136 - (insize%-1)*10
  Use Toolbox routine to set a rectangle for whole of input layer display
  SetRect recs%(0),xin%,yin%,xin%+insize%*20,yin%+insize%*20
  Draw all input neurons as outline squares
  FOR x% = xin% TO 115 + (insize%-1)*10 STEP 20
     FOR y% = yin% TO 136 + (insize%-1)*10 STEP 20
        LINE(x%,y%)-STEP(18,18),,b
     NEXT
  NEXT
  xout% = 367 - (outsize%-1)*10
  yout% = 136 - (outsize%-1)*10
  Use Toolbox routine to set a rectangle for whole of output layer display
  SetRect recs%(4),xout%,yout%,xout%+outsize%*20,yout%+outsize%*20
  Draw all output neurons as outline squares
  FOR x% = xout% TO 367 + (outsize%-1)*10 STEP 20
     FOR y% = yout% TO 136 + (outsize%-1)*10 STEP 20
        LINE(x%,y%)-STEP(18,18),,b
     NEXT
  NEXT

  BUTTON 1,1,"OK",(45,270)-(115,290),1
  BUTTON 2,2,"Train network",(165,255)-(320,275),3
  BUTTON 3,1,"Test pattern",(165,280)-(320,300),3
RETURN
```

continues...

time, but at least it made it possible to study networks of a useful size. During the 1960s neural nets suddenly became fashionable, attracting many researchers eager to explore the possibility of recreating some of the brain's unique abilities. Prominent among them was Frank Rosenblatt of Cornell University, who devised the Perceptron — an artificial vision system using a matrix of photocells as the retina. The outputs of the photocells were fed to a simple neural network that could be trained to recognise visual patterns.

At last, it seemed as if the two strands of information processing were coming together. But the enthusiasm was short-lived. In 1969 Marvin Minsky, one of the gurus of computer science, and Seymour Papert, best known as creator of the LOGO language, showed mathematically that Perceptrons could never form the basis for a general computer. Work on neural networks virtually stopped.

The great Perceptron debacle was based on perfectly valid criticisms but it might have been easily avoided. Perhaps the Perceptron's supporters claimed too much; perhaps they just needed more time to create more sophisticated networks. Whatever the cause of the problem, it took about 15 years before neural networks could return from the wilderness. That return is now taking on the appearance of a triumphal homecoming. A new name — 'Connectionism' — is emblazoned on the banner and new theories legitimise the neural approach.

Soft in the head

Creating a software model of the sort of neural cells that are inside our heads is, in principle, a straightforward task, though the restrictions of processor speed and memory capacity still limit us to very small nets. Nevertheless, interesting behaviour can be observed even in network simulations on a home micro.

Two aspects need to be considered in designing any neural network. One is the overall pattern of interconnections that makes the net. The other is the detailed performance of each individual neuron. Any software neuron must be capable of simulating five important functions:

- **Input** According to the arrangement of the network, the neuron must be able to read the output values of various other neurons and use them for calculating its own level of activity. In the simplest form — the McCulloch-Pitts neuron — these are the binary values 1 and 0 (firing or not firing), though it is

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Ultra 30MB color	$2500

THE DISCWARE AT-286 – MADE IN USA $2995

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INPUT/OUTPUT:	Parallel/Serial.
POWER:	225 watt power supply.
OPTIONS INC:	Mono or Colour Card. Key Lock 12 months warranty.

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MODEL	T3100	T3200	T5100
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RAM:	640 KB	1 MB	2 MB
DISK STORAGE:	720 KB + 20 MB	720 KB + 40 MB	1.44 MB + 40 MB
INPUT/OUTPUT:	Ser/Par/Exp	Ser/Par/Exp/2 slots	Ser/Par/Exp

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PRICE:	$1515	$2500
MODEL:	XT floppy	XT30MB
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INPUT/OUTPUT:	serial/parllel/game port/8 slots	
SCREEN:	mono	colour

AST Premium 286

MODEL:	85	140
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RAM:	1 MB	1 MB
DISK STORAGE:	1.2 MB	1.2 MB + 40 MB
INPUT/OUTPUT:	serial/parallel/7 slots	

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```
Pattern:
   Allow user to draw a pattern of active neurons in either layer
   MENU ON
   DIALOG ON
   If last pattern was a test result then keep it until mouse is clicked
   IF choice% = 1 THEN GOTO skip
   WHILE MOUSE(0) > -1
   WEND
   skip:
   GOSUB Clearneurons
   Allow pattern entry until OK button is pressed
   done% = 0
   WHILE done% = 0
      GetMouse pt%(0)
      Invert colour beneath pointer
      IF POINT(pt%(1),pt%(0)) = 30 THEN col% = 33 ELSE col% = 30
      WHILE MOUSE(0) < 0
         GetMouse pt%(0)
         PtInRects pt%(0),recs%(0),2,side%
         ON side% GOSUB Drawin, Drawout
      WEND
   WEND
   MENU OFF
   DIALOG OFF
RETURN

Drawin:
   Calculate position of input cell pointed to and plot it
   xpos% = INT((pt%(1) - xin%)/20)
   ypos% = INT((pt%(0) - yin%)/20)
   LINE(xin%+1+xpos%*20,yin%+1+ypos%*20)-STEP(16,16),col%,bf
   a%(xpos% + ypos%*insize%) = SGN(col%-30)
RETURN

Drawout:
   Calculate position of output cell pointed to and plot it
   xpos% = INT((pt%(1) - xout%)/20)
   ypos% = INT((pt%(0) - yout%)/20)



   LINE(xout%+1+xpos%*20,yout%+1+ypos%*20)-STEP(16,16),col%,bf
   b%(xpos% + ypos%*outsize%) = SGN(col%-30)
RETURN

Clearneurons:
   Clear all neurons to zero output
   FOR  xpos% = 0 TO insize%-1
      FOR ypos% = 0 TO insize%-1
         a%(xpos%+ypos%*insize%) = 0
         LINE(xin%+1+xpos%*20,yin%+1+ypos%*20)-STEP(16,16),30,bf
      NEXT
   NEXT
   FOR  xpos% = 0 TO outsize%-1
      FOR ypos% = 0 TO outsize%-1
         b%(xpos%+ypos%*outsize%) = 0
         LINE(xout%+1+xpos%*20,yout%+1+ypos%*20)-STEP(16,16),30,bf
      NEXT
   NEXT
RETURN

Matrix:
   Recalculate all connections to incorporate current training example
   FOR i% = 0 TO insize%*insize%-1
      FOR j% = 0 TO outsize%*outsize%-1
         c%(i%,j%) = c%(i%,j%) + ((a%(i%)*2-1)*(b%(j%)*2 - 1))
      NEXT
   NEXT
 RETURN
 Compute:
   Calculate both neuron layers until the whole net is stable
   recalc:
```

continues...

often more useful to read these as 1 and -1. More complex neurons may use a range of discrete values or a continuous range — possibly, between 0 and 1.

- **Weightings** It is known that real neurons have connections of different strengths, so that the same input will affect one neuron more than another. To simulate this, it is usual to assign a weight to each input. This may be positive or negative (for excitatory or inhibitory inputs) and take discrete or continuous values. The weight multiplied by the received input gives the value that will actually be used by the cell.
- **Summation** An overall input strength is found by summing all the weighted inputs and taking account of positive and negative values. This sum represents the total excitation available to the cell.
- **Threshold** In order to fire, a brain cell needs its input sum to exceed a preset threshold value. This not only reduces the effects of random noise but gives the cell the ability to discriminate between input values. Similarly, any simulated neurons must do the same. If the input sum falls below the threshold, then there is no output; if it is above, then an output will be generated.
- **Transfer function** In the binary McCulloch-Pitts cell the output is simply determined by the threshold function: 0 if the input is below, 1 if it is above the threshold. In cells that have a range of values, there is still no output below the threshold but, above it, some function needs to relate input to output. This may be as complex as required.

A single neuron is relatively simple to build as hardware and is easily simulated in software. The complexity all resides in the intricacies of the network. Large numbers of neurons, heavily interconnected, create a system of pent-up energy.

Let us suppose that a network is set up with some initial set of values for the weights and that all the cells are quiescent. If some input signals are now applied, cells may begin to fire, providing input to further cells which may in turn excite or inhibit other cells, and so on. The whole network will eventually settle into a stable state consisting of some pattern of cell outputs. We can treat this whole pattern, or some small part of it, as being the output of the net.

Neural nets tend to be arranged in layers; generally, all the cells in one layer take their inputs from neurons in the preceding layer and pass their outputs on to the next one, but there are no hard and fast rules about this. The degree of connectivity between layers is also variable: in a fully connected

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net, each cell will take inputs from every cell in the previous layer; conversely, neurons may take just a small number of inputs, perhaps from randomly chosen cells. Just as there are many different arrangements of cells within the brain, so there are many types of artificial neural nets and new ones are constantly being devised. The aim is always to find a layout of connections and a distribution of weights such that we can enter certain inputs and obtain outputs which are related to them in some useful way.

With any conventional computer, we would need to create an algorithm — a sequence of instructions that carries out the required task. Neural networks on the other hand, need to be trained by example — we either set an input and directly force connection weights that will give the desired output or allow a combination of weights to develop by iterative steps until the correct output is achieved. Finding learning rules to modify the weights so that the network will rapidly move towards a correct and stable state is one of the central problems of the subject. It was a major factor in the recent unpopularity of neural networks.

The glaring fault that Minsky and Papert had identified in the Perceptron back in 1969 was that there was no way to create an Exclusive . . . OR function: that is, no way of making a cell fire if one, and only one, of two input cells was firing. Without the ability to perform an Exclusive . . . OR, large areas of computing were inaccessible.

The Perceptron was a quite simple device with just two neuron layers, one connected to the retina, the second providing the output, with a learning rule to set the connection weights between them. The solution which emerged after Minsky and Papert's critique was that the only way to provide an Exclusive . . . OR was to introduce at least one further 'hidden' layer of neurons between input and output. Unfortunately, no-one could find a learning rule that would deal with hidden units. Hence the long exile of neural networks.

Recently a number of new learning rules have been found to solve the problem. The basis of all these methods is to apply the input and allow cell activity to propagate through to the output layer. Then compare this output with the desired output values and adjust connection weights throughout the net according to a mathematical function that will reduce the error. This process is repeated, perhaps thousands of times, until a stable distribution is produced.

```
      diff% = 0
      First calculate and plot output layer from pattern in input layer
      FOR j% = 0 TO outsize%*outsize%-1
      s% = 0
      Sum all inputs times their connection weights
      FOR i% = 0 TO insize%*insize%-1
         s% = s% + a%(i%)*c%(i%,j%)
      NEXT
      Save previous value of neuron to see if it is changing
      old% = b%(j%)
      Check summed input against threshold
      IF s% > 0 THEN b%(j%) = 1
      IF s% < 0 THEN b%(j%) = 0
      x% = xout%+1+(j% MOD outsize%)*20
      y% = yout%+1+(j%\outsize%)*20
      LINE(x%,y%)-STEP(16,16),30+3*b%(j%),bf
      If neuron has changed then increment diff%
      diff% = diff% + ABS(b%(j%)-old%)
      MENU ON
      MENU STOP
   NEXT
   Now calculate and plot input layer from pattern in output layer
   FOR i% = 0 TO insize%*insize%-1
      s% = 0
      FOR j% = 0 TO outsize%*outsize%-1
         s% = s% + b%(j%)*c%(i%,j%)

      NEXT
      old% = a%(i%)
      IF s% > 0 THEN a%(i%) = 1
      IF s% < 0 THEN a%(i%) = 0
      x% = xin%+1+(i% MOD insize%)*20
      y% = yin%+1+(i%\insize%)*20
      LINE(x%,y%)-STEP(16,16),30+3*a%(i%),bf
      diff% = diff% + ABS(a%(i%)-old%)
      MENU ON
      MENU STOP
   NEXT
   Recalculate net if any neuron has changed its value since last time
   IF diff% > 0 THEN GOTO recalc
RETURN
Quit:
   MENU RESET
   END
RETURN
```

List of Variables Used in Associative Memory

a%	Array - holds values of all neurons in input layer
action%	Returned by Dialog function - shows type of last user action
b%	Array - holds values of all neurons in output layer
c%	Array - holds connection weights between all pairs of neurons
choice%	Choice of training or testing as selected by radio buttons
col%	Colour being painted - white = 30, black = 33
diff%	Number of neurons changed in current calculation
done%	Flag - set to 1 when OK button or Return pressed
edfield%	Number of currently selected edit field
i%	General purpose loop counter
insize%	Extent of input layer
j%	General purpose loop counter
menuitem%	Number of item in menu selection
menunumber%	Number of menu bar selection
number%	Number returned by Dialog function of selected button or edit field
old%	Temporary variable for last value of neuron
outsize%	Extent of output layer
pt%	Array - holds mouse position (y,x) as returned by GetMouse
recs%	Array - holds corner co-ordinates of input and output layers
s%	Sum of all weighted inputs to a neuron
side%	Returned by PtInRects - 1 if mouse is in input layer, 2 if in output
state%	Number of currently active radio button
x%	X co-ordinate of top left corner of current neuron
xin%	X co-ordinate of top left corner of input layer
xout%	X co-ordinate of top left corner of output layer
xpos%	Column number of current neuron
y%	Y co-ordinate of top left corner of current neuron
yin%	Y co-ordinate of top left corner of input layer

continues

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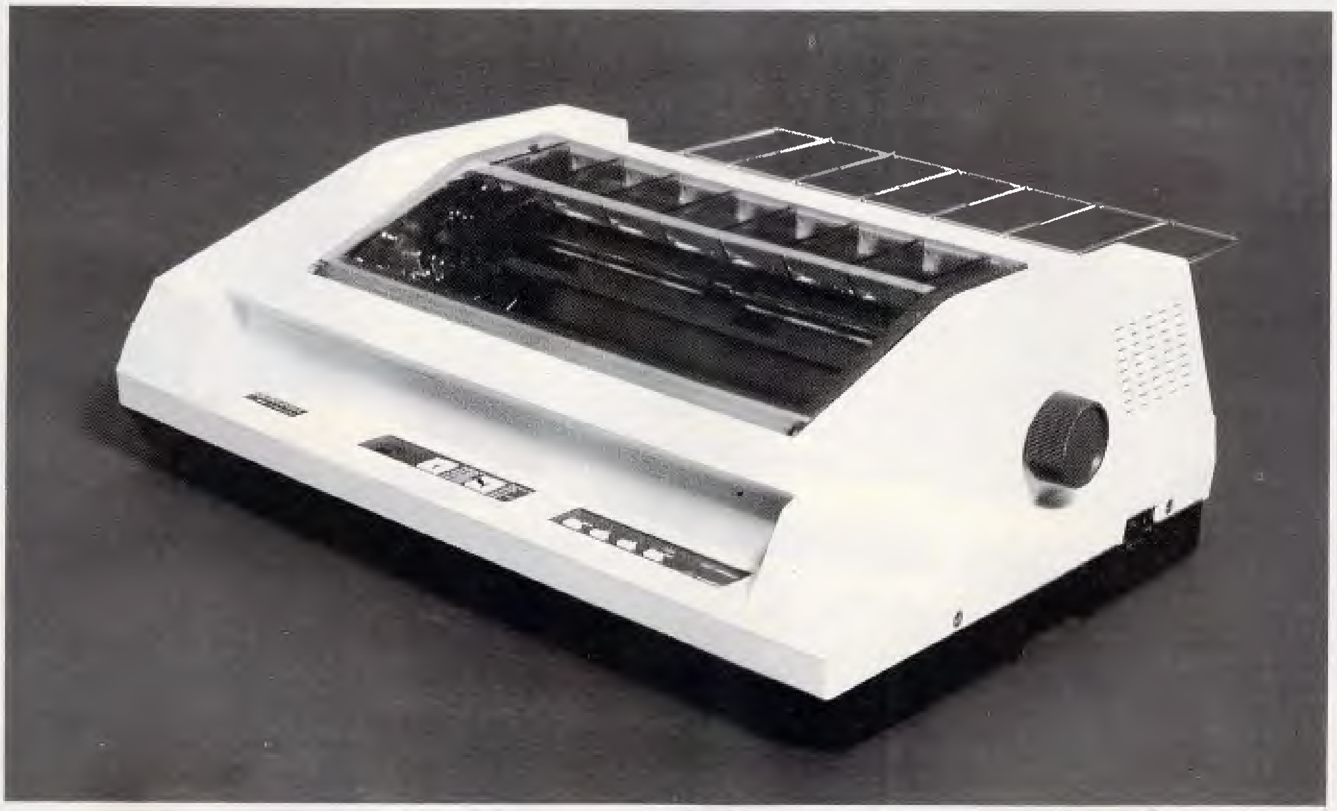

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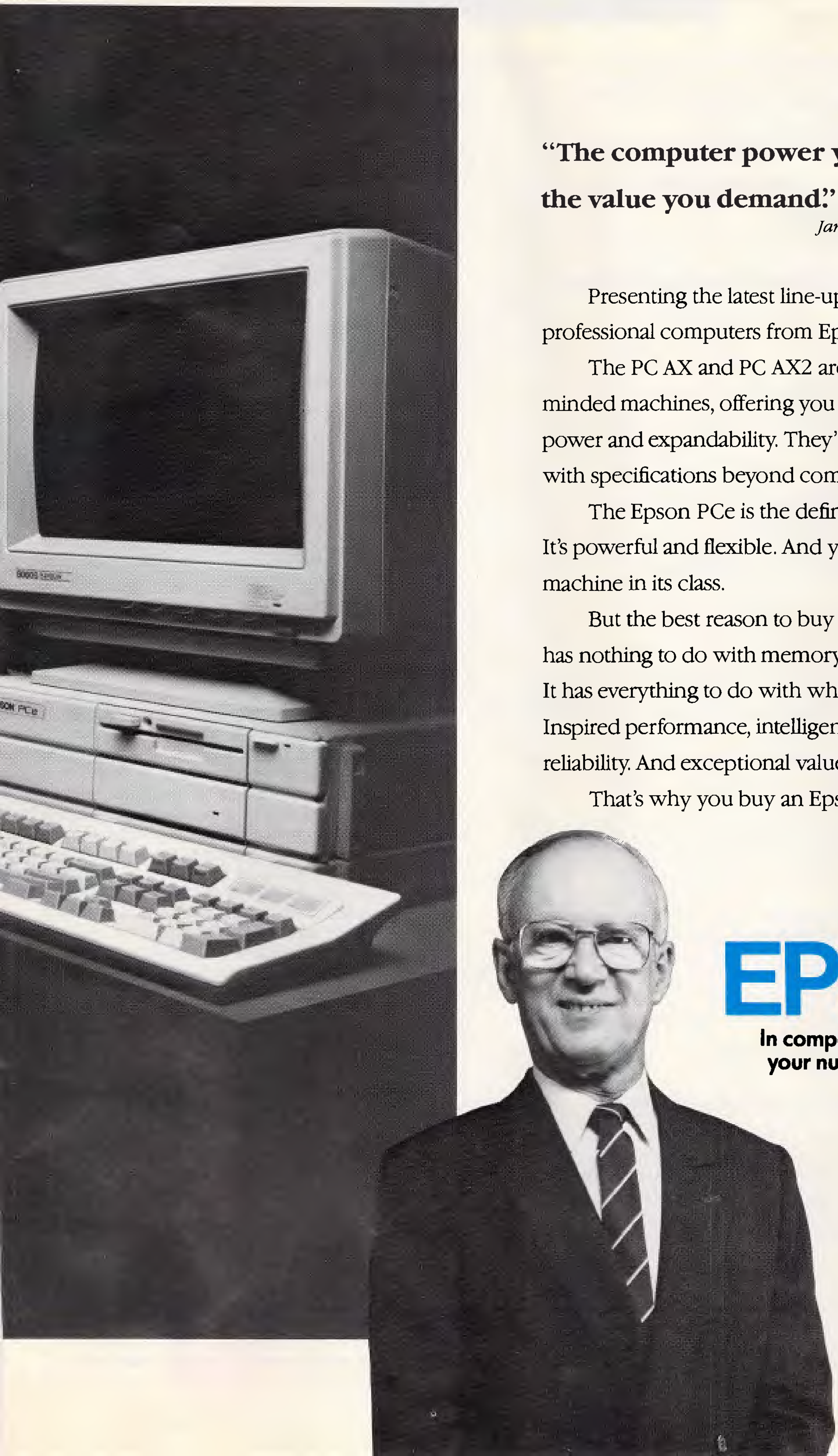

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```
yout%          Y co-ordinate of top left corner of output layer
ypos%          Row number of current neuron

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  Constructs randomly connected neural network
    'WISARD' type pattern discriminator
    Single pass operation
    Visual input/output

  --------------------------------------------------------------------
    Runs on Apple Macintosh under MS Basic v3.0 with Toolbox Library
  --------------------------------------------------------------------

ON BREAK GOSUB Quit
GOSUB Initialise
net:
GOSUB Clearin
GOSUB Clearout
GOSUB Buildnet
GOSUB Display
loop:
GOSUB Pattern
FOR i% = 2 TO 4
  state% = BUTTON (i%)
  IF state% = 2 THEN choice% = i%-1
NEXT
IF choice% < 3 THEN discriminator% - choice%
ON choice% GOSUB Setvalues, Setvalues, Compute
GOTO loop
END
    --------------------------------------------------------------------

Initialise:
  DIM a%(99), b%(19,4), b1%(19,4), b2%(19,4), p%(4),pt%(1),rec%(3)
  RANDOMIZE TIMER
  Declare name of file containing Toolbox Library routines for this program
  LIBRARY "MyDisk:NetLib"
  plot% = 0
  Create array of coefficients (1,2,4,8,16) for five input cells in a group
  FOR i% = 0 TO 4
    p%(i%) - 2^i%
  NEXT
  WINDOW 1,,(7,25)-(507,335),3
  Put network options into menu bar
  MENU 6,0,1,"Network"
  MENU 6,1,1,"New net"
  MENU 6,2,1,"Quit"
  ON MENU GOSUB Menuhandle
  ON DIALOG GOSUB Dialoghandle
  MENU ON
   DIALOG ON
 RETURN
 Menuhandle:
   A menu selection has been made - divert program to restart or quit
   menunumber% = MENU(0)
   IF menunumber% <> 6 THEN RETURN
   menuitem% = MENU(1)
   MENU
    IF menuitem% -1 THEN GOTO net ELSE GOSUB Quit
  RETURN

  Dialoghandle:
    A button or the Return key has been pressed - find which
    action% = DIALOG(0)
    number% - DIALOG(action%)
    IF action% = 1 THEN GOSUB Dobutton
    IF action% = 6 THEN done% = 1
  RETURN

  Dobutton:
    A button has been pressed - find its number, toggle buttons if needed
    IF number% = 1 THEN done% = 1: RETURN
    FOR i% = 2 TO 4
      IF i% = number% THEN BUTTON i%,2 ELSE BUTTON i%,1
```

continues

Vision & hearing

The sorts of problems that are particularly suitable for neural network solution are those for which no algorithm is known, or where the only available algorithms are themselves too time-consuming. An excellent example is the travelling salesman problem in which the shortest route joining a number of cities needs to be found. As the number of cities increases, the problem rapidly becomes unmanageable; 10 cities, for instance, offer 181,440 different routes and there is no known algorithm for finding the shortest one other than calculating and comparing them all. Recently, trials with a neural network at Bell Laboratories gave a best or nearly best answer about 75% of the time. With a specially built hardware network it is thought that such answers could be provided in a fraction of a second.

But given training in the form of matched pairs of written words and phoneme patterns, it adjusts its connections until, after about a day, it is chattering away pretty intelligibly.

Neural networks are especially successful in the traditional AI activities of robot vision and speech recognition. One of the most talked about networks at the moment is NETalk. It is a self-learning net built at Princeton University which takes text as its input and drives a phonemic speech synthesiser with its output. Initially, with random connection weights, it babbles completely incoherently. But given training in the form of matched pairs of written words and phoneme patterns, it adjusts its connections until, after about a day, it is chattering away pretty intelligibly.

But image processing has produced perhaps the most practical applications: the Perceptron, remember, was an early vision system and now one of the few neural networks to have become a commercial product is a visual device called WISARD.

Designed at Brunel University, WISARD consists of a video camera attached to a large but simple network. It can successfully tackle problems that would be way beyond traditional algorithmic AI techniques. For example, train it on a number of smiling faces and a

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Other possible uses are optical character recognition, analysis for medical imaging, deciphering hand-writing and so on. These are tasks for which no rigid algorithmic set of instructions exists, but neural networks excel at precisely such problems. What matters is that there are genuine similarities between smiling faces or between all examples of the letter 'A'; we may not know how to define those similarities but, with a neural network, we don't need to. Their internal workings are just a means to an end: we don't need to specify them, we don't even need to *know* them. WISARD is one of those nets which has totally random internal connections.

Conclusion

As long as the bulk of research is done on simulated nets the real world applications may be restricted, but already some special neural network chips have been built by Bell Laboratories and they offer the prospect of true parallel processing speeds. Going even further, the obvious technology for such massively parallel structures is optical processing. At the California Institute of Technology, a pattern recognition system has been built which, given an input image, can select the matching image out of several stored within a hologram. So far, its achievements may appear modest. But the fact that holograms offer enormous storage density and that light beams can cross each other without interference implies that very large and dense neural nets may be achieved in this way.

Ultimately, what makes neural network research important to us is the possibility that it may provide analogies for how the brain works. If that is the case then it offers the prospect of some real artificial intelligence. But, more importantly, it could open a window into the brain. Being able to simulate even just a tiny portion of the brain would help us to understand it, and perhaps make better use of it.

END

Neural networks listings

*(This program has been written in Microsoft Basic for the Apple Macintosh, but shouldn't be too difficult to convert to other languages and machines. The listing is available through Microtex on Viatel (see page *6663#), or by sending a blank formatted disk with a stamped self-addressed packet to 'Neural Network', c/-* APC, *124 Castlereagh Street, Sydney 2000.*

```
  NEXT
RETURN

Buildnet:
   Create random connections between input and output neurons
   Change to wristwatch cursor while building up the network
   ChangeCursor 4
   FOR i% = 0 TO 19
      FOR j% - 0 TO 4
         repeat:
         cell% = INT(RND(1)*100)
         IF a%(cell%) = 1 THEN GOTO repeat
         a%(cell%) = 1
         b%(i%,j%) = cell%
      NEXT
   NEXT
   Restore default cursor
   CALL INITCURSOR
RETURN

Display:
   Create screen layout to display the discriminator network
   CALL TEXTFONT(0)
   CALL MOVETO(110,25)
   PRINT "Input"
   CALL MOVETO(308,25)
   PRINT "Discriminators"
   Use Toolbox routine to set rectangle for input layer
   SetRect rec%(0),25,46,225,246
   FOR x% = 25 TO 205 STEP 20
      FOR y% =  46 TO 226 STEP 20
         LINE(x%,y%)-STEP(18,18),,b
      NEXT
   NEXT
   FOR x% - 307 TO 387 STEP 20
      FOR y% = 46 TO 106 STEP 20
         LINE(x%,y%)-STEP(18,18),,b
      NEXT
   NEXT
   FOR x% = 307 TO 387 STEP 20
      FOR y% = 166 TO 226 STEP 20
         LINE(x%,y%)-STEP(18,18),,b
      NEXT
   NEXT
   BUTTON 1,1,"OK",(45,270)-(115,290),1
   BUTTON 2,2,"Train discriminator 1",(170,255)-(325,275),3
   BUTTON 3,1,"Train discriminator 2",(170,280)-(325,300),3
   BUTTON 4,1,"Test pattern",(350,265)-(490,285),3
   example1% = -1
   example2% = -1
RETURN

Pattern:
   Allow user to enter pattern into input neurons
   DIALOG ON
   Hold existing pattern until mouse is clicked
   WHILE MOUSE(0) > -1
      MENU ON
      MENU STOP
     WEND
     Clear all cells and old scores
      GOSUB Clearin
      GOSUB Clearout
      LINE(290,130)-(450,155),30,bf
      Look for mouse events until OK is pressed
      done% = 0
      WHILE done% - 0
         GetMouse pt%(0)
         Invert colour beneath pointer
         IF POINT(pt%(1),pt%(0)) = 30 THEN col% = 33 ELSE col% = 30
         Continue painting cells during drag
         WHILE MOUSE(0) < 0
            GetMouse pt%(0)
            PtInRect pt%(0), rec%(0), plot%
            IF plot% = -1 THEN GOSUB Draw
```

continues

Australian Personal Computer

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(Australian Personal Computer ‘Low cost IBM Compatible’ Survey — October 1987 issue.)

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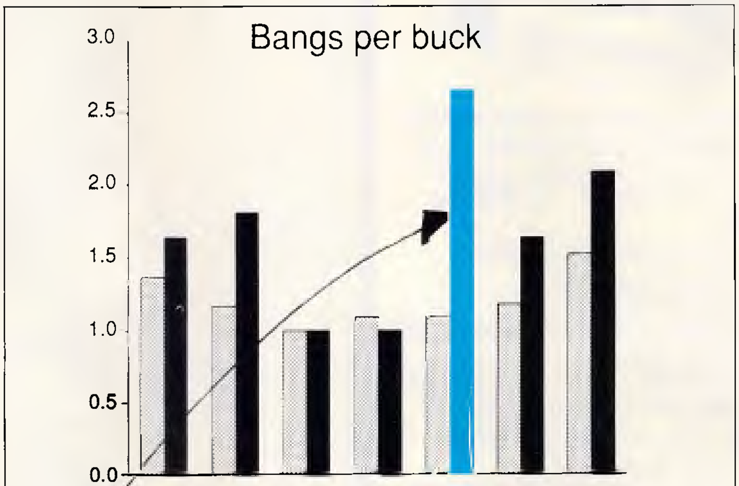

‘Bangs per buck’ — just one way of comparing the relative merits of these seven ultra-cheap clones. The lighter shading denotes price (in thousands of dollars) and the darker shading a performance index. See Table 3 for more details. (Machines in order from left to right are from Altantis, Rod Irving, MicroDOS, Commodore, Uni-x, Altronics and Technology Interface)

Processor.

NEC. The Uni-x contains a NEC V20, manufactured by Sony.

Thus a V20 running at 4.77MHz will outrun an 8088 running at the same clock speed.

machines examined provided a standard PC clock rate of 4.77MHz as a minimum, although the Uni-x delivered higher than standard performance even on this clock rate by virtue of the V20. The Atlantis and machines

Performance.

The Uni-x is fastest overall, providing a 50 per cent boost over the Technology Interface due to the V20.

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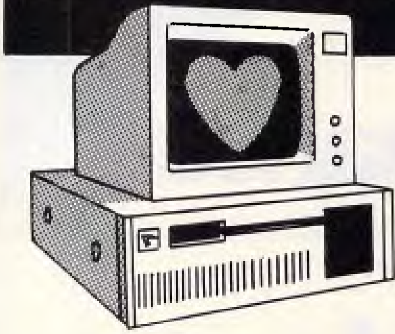

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```
      WEND
    WEND
    DIALOG OFF
RETURN
Draw:
    Find cell currently pointed to and paint it
    xpos% = INT((pt%(1) - 25)/20)
    ypos% = INT((pt%(0) - 46)/20)
    LINE(26+xpos%*20,47+ypos%*20)-STEP(16,16),col%,bf
    a%(xpos% + ypos%*10) = SGN(col%-30)
RETURN

Clearin
    Clear all input neurons to zero output
    FOR  xpos% = 0 TO 9
      FOR ypos% = 0 TO 9
        a%(xpos%+ypos%*10) = 0
        LINE(26+xpos%*20,47+ypos%*20)-STEP(16,16),30,bf
      NEXT
    NEXT
RETURN

Clearout:
    Clear all discriminator cells to zero
    FOR  xpos% = 0 TO 4
      FOR ypos% = 0 TO 3
        LINE(308+xpos%*20,47+ypos%*20)-STEP(16,16),30,bf
        LINE(308+xpos%*20,167+ypos%*20)-STEP(16,16),30,bf
      NEXT
    NEXT
    LINE(420,70)-(450,220),30,bf
RETURN

Setvalues:
    Add values based on current training example to its discriminator
    IF discriminator% = 2 THEN GOTO second
    Only five training examples allowed per discriminator
    example1% = example1% + 1
    IF example1% > 4 THEN GOSUB Toomany: RETURN
    FOR i% = 0 TO 19
    s% = 0
    For each group of five cells, find a value and store it
      FOR j% = 0 TO 4
        s% = s% + a%(b%(i%,j%))*p%(j%)
      NEXT
      b1%(i%,example1%) = s%
    NEXT
    GOTO inclear
    second:
    As above but for second discriminator
    example2% = example2% + 1
    IF example2% > 4 THEN GOSUB Toomany: RETURN
    FOR i% = 0 TO 19
    s% = 0
      FOR j% = 0 TO 4
        s% = s% + a%(b%(i%,j%))*p%(j%)
      NEXT
      b2%(i%,example2%) = s%
      NEXT
      inclear:
      GOSUB Clearin
    RETURN

    Toomany:
      User attempted to enter more than 5 examples for a discriminator
      BEEP
      CALL MOVETO(290,150)
      PRINT "Too many examples!"
      GOSUB Clearin
    RETURN

    Compute
      Calculate current example's scores on both discriminators
      score1% = 0
```

continues

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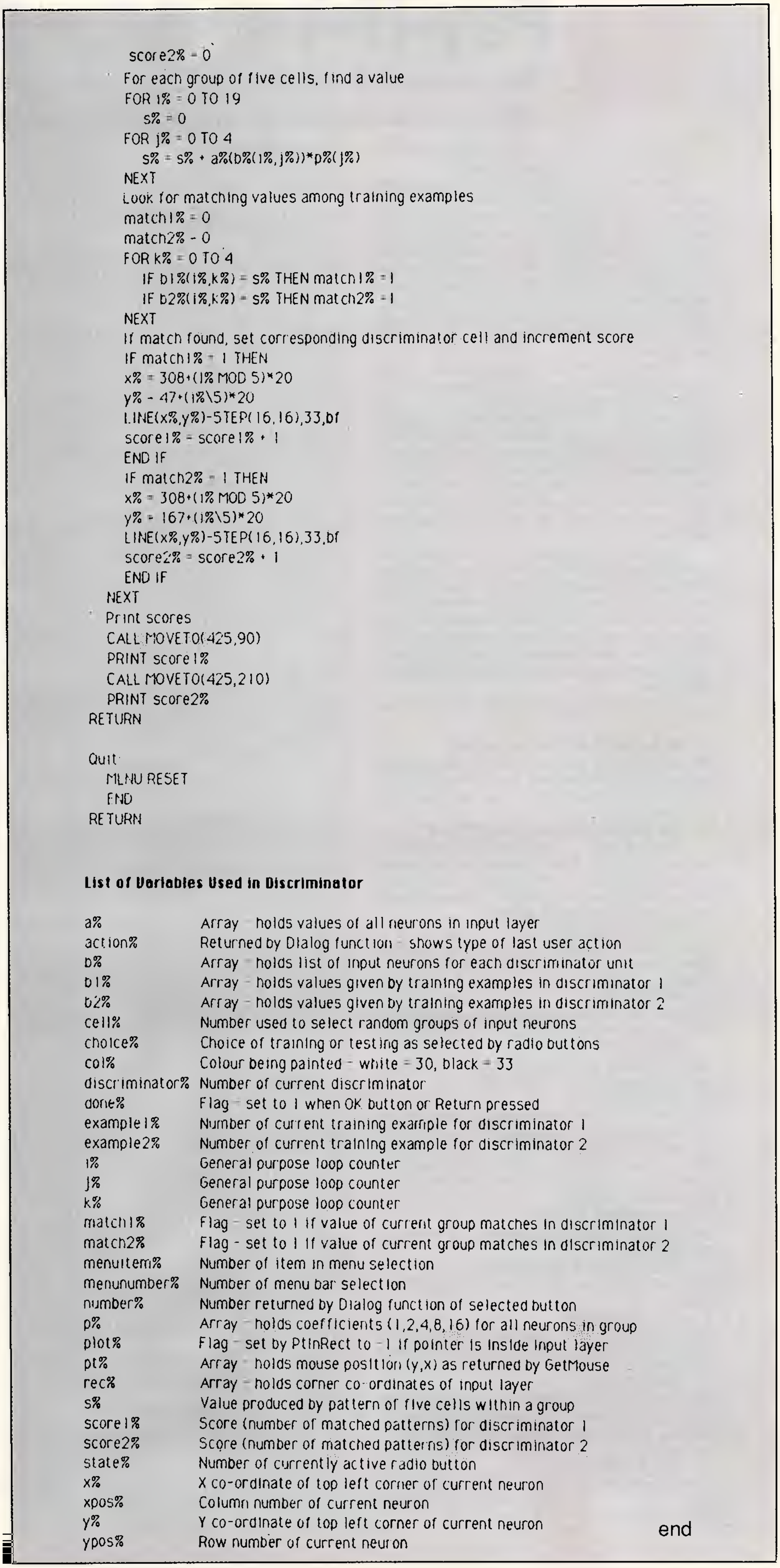


```
       score2% = 0
     ' For each group of five cells, find a value
     FOR i% = 0 TO 19
        s% = 0
     FOR j% = 0 TO 4
        s% = s% + a%(b%(i%,j%))*p%(j%)
     NEXT
     Look for matching values among training examples
     match1% = 0
     match2% - 0
     FOR k% = 0 TO 4
        IF b1%(i%,k%) = s% THEN match1% = 1
        IF b2%(i%,k%) = s% THEN match2% = 1
     NEXT
     If match found, set corresponding discriminator cell and increment score
     IF match1% = 1 THEN
     x% = 308+(1% MOD 5)*20
     y% - 47+(i%\5)*20
     LINE(x%,y%)-STEP(16,16),33,bf
     score1% = score1% + 1
     END IF
     IF match2% = 1 THEN
     x% = 308+(1% MOD 5)*20
     y% = 167+(i%\5)*20
     LINE(x%,y%)-STEP(16,16),33,bf
     score2% = score2% + 1
     END IF
   NEXT
 ' Print scores
   CALL MOVETO(425,90)
   PRINT score1%
   CALL MOVETO(425,210)
   PRINT score2%
RETURN

Quit:
   MENU RESET
   END
RETURN
```

List of Variables Used in Discriminator

a%	Array - holds values of all neurons in input layer
action%	Returned by Dialog function - shows type of last user action
b%	Array - holds list of input neurons for each discriminator unit
b1%	Array - holds values given by training examples in discriminator 1
b2%	Array - holds values given by training examples in discriminator 2
cell%	Number used to select random groups of input neurons
choice%	Choice of training or testing as selected by radio buttons
col%	Colour being painted - white = 30, black = 33
discriminator%	Number of current discriminator
done%	Flag - set to 1 when OK button or Return pressed
example1%	Number of current training example for discriminator 1
example2%	Number of current training example for discriminator 2
i%	General purpose loop counter
j%	General purpose loop counter
k%	General purpose loop counter
match1%	Flag - set to 1 if value of current group matches in discriminator 1
match2%	Flag - set to 1 if value of current group matches in discriminator 2
menuitem%	Number of item in menu selection
menunumber%	Number of menu bar selection
number%	Number returned by Dialog function of selected button
p%	Array - holds coefficients (1,2,4,8,16) for all neurons in group
plot%	Flag - set by PtInRect to -1 if pointer is inside input layer
pt%	Array - holds mouse position (y,x) as returned by GetMouse
rec%	Array - holds corner co-ordinates of input layer
s%	Value produced by pattern of five cells within a group
score1%	Score (number of matched patterns) for discriminator 1
score2%	Score (number of matched patterns) for discriminator 2
state%	Number of currently active radio button
x%	X co-ordinate of top left corner of current neuron
xpos%	Column number of current neuron
y%	Y co-ordinate of top left corner of current neuron
ypos%	Row number of current neuron

end

Class system

In the third of his articles on the Smalltalk programming environment, Carl Phillips describes more of its unconventional characteristics — and how it uses a class-conscious way of getting the message across.

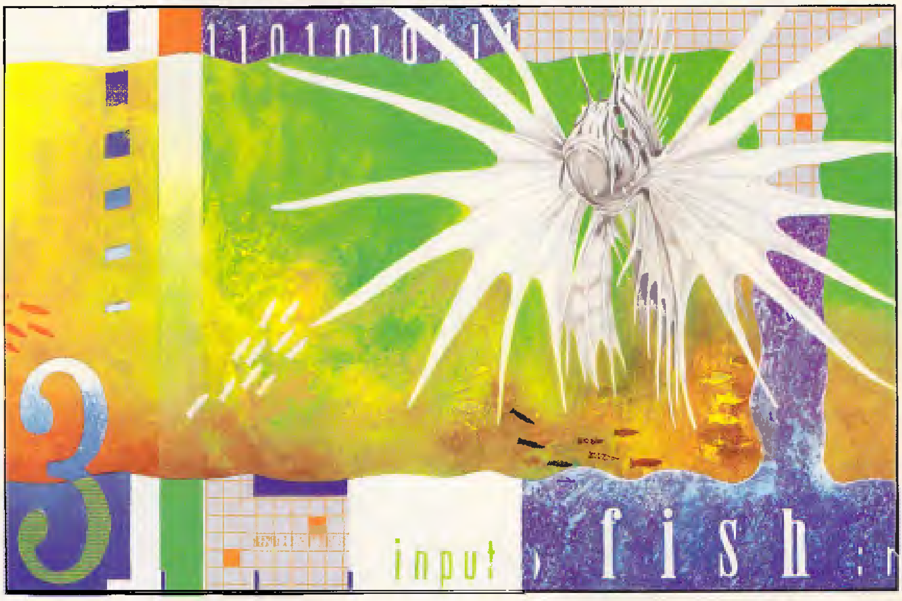
Every component of the Smalltalk universe is represented by objects. Objects communicate by sending and receiving messages. The object that receives a message is called the receiver; the object that sends a message the sender.

Message expressions have three basic forms: unary, with just a single selector; binary, with a selector and a single argument; and keyword, with a sequence of selectors separated by colons and arguments (see Fig 1). To respond to a particular message, an object executes a method with the same name and number of arguments as the message itself.

Methods are a sequence of Smalltalk statements separated by '.' characters. Like message expressions, Smalltalk statements have three basic forms: a message expression; a message expression preceded by the assignment prefix (,<- or := depending on the particular Smalltalk implementation); and a message expression preceded by the return character (^) (see Fig 2). Message expressions, statements, and methods always return a value which is an object.

Objects are grouped into classes. All objects are said to be an instance of some class and all instances of a particular class share the same structure and set of messages. Class definitions specify the structure and methods for instances of that class. Classes are themselves grouped in a tree structure. Classes inherit methods from the parent superclass above them in the tree. In Xerox Smalltalk-80 and Digitalk Smalltalk/V, the instance variables of parent superclasses are also inherited by subclasses. In Little Smalltalk, only methods are inherited.

Smalltalk has five different types of variable. Instance variables belong to objects and represent their private data store. Class variables belong to classes and are accessible to all instances of a particular class. Class pool variables are shared between multiple classes. Global variables are available to all parts of the system. Finally, there is one type of variable we haven't encountered yet: pseudo-variables. (Little Smalltalk has only a subset of these variable types — instance variables and a single global variable called 'smalltalk'.)



Smalltalk pseudo-variables

Smalltalk has a number of specially reserved variable names called pseudo-variables. They look like variable names but have some special purpose within the system. Pseudo-variables cannot have values assigned to them using the assignment prefix (<- or :=) and the Smalltalk compiler will complain if you try. For this reason the arguments to a method are also categorised as pseudo-variables.

The most important pseudo-variables are named 'self' and 'super'. These give you control over the method of look-up process that happens when a Smalltalk object receives a message. 'Self' is a pseudo-variable that refers to the object that received the currently executing method. 'Self' lets an object refer to its current value or send a message to itself (hence the name) without having to know its name or class. Fig 3 illustrates how 'self' can be used in a method definition.

The pseudo-variable 'super' is like 'self' in that it refers to the receiver of the currently executing method. However, when processing a message where 'super' is the receiver, the Smalltalk interpreter does not start searching for a matching method in the current object's class. Instead, it starts searching in the object's superclass. This is useful when a method has been overridden in the current object's class but you still want to call the original method in the superclass.

Some Smalltalk classes prohibit the creation of more than one instance of that class. 'Nil' is a pseudo-variable that represents the special object that is the sole instance of a class called

UndefinedObject. 'Nil' is the default value that instance variables get when an object is created. If a message is accidentally sent to a variable containing the 'nil' object, a run-time error message will be generated.

'Nil' is Smalltalk's way of checking at run-time for uninitialised variables. Many C and Pascal systems check for 'null' pointer references when you try to store something indirectly with a pointer variable that has not been initialised and is pointing somewhere wild. 'Nil' is a similar idea. If the 'nil' object ever gets a message, an error is posted.

'True' and 'false' are two other pseudo-variables. They are the sole instances of Classes True and False which are subclasses of Class Boolean and represent, as you would expect, logical true and false.

Classes True and False include methods that implement (among others) the methods that respond to the ifTrue: and ifFalse: messages for conditional selection in Smalltalk.

In Class True the ifTrue: method looks like this:

```
ifTrue: argumentBlock
  ^argumentBlock value
```

In Class False the ifTrue: method looks like this:

```
ifTrue: argumentBlock
  ^nil
```

So if a variable holds the object true and gets an ifTrue: message, it will return the value created by executing the block aBlock. If a variable holds the object false, it does not evaluate the block and just returns 'nil'.

For the ifFalse: message, things are reversed. In Class True:

```
if False: argumentBlock
  ^nil
```

In Class False:

```
ifFalse: argumentBlock
  ^argumentBlock value
```

```
Three different forms:

Unary  -  4 asString, x sin, aString toUpper, aCollection includes: 4
 65, 12.5 / 6, 2r1101 // 8
Keyword - 'Hello world' at:7 put: $W, a max: b
```

Fig 1 Example Smalltalk message expressions

```
Built out of message expressions. Three different forms:

Message  expression       - x sin, 4 + 6, 'Hello  world' at:7 put:$W
Assignment expression     - x:= 4+6, y:=12.5/6, z:=2r1101 //8
Return expression         - ^4+6, ^12.5/6, ^a max: b
```

Fig 2 Example Smalltalk statements

```
factorial
    "This method returns the factorial of a number in Smalltalk-80"
    self > 1
        ifTrue: [^self * (self - 1) factorial].
    self = 1
        ifTrue: [^1].
    self error: 'Invalid argument to factorial'

      It could be added to class Integer if you want to try it.
```

Fig 3 Example Smalltalk method

```
Class Person: Object          "Person is a subclass of Object"
¦ name age job¦               "Three instance variables"
[
name
    ^name
¦
name: aString
    name:=aString
¦
age
    ^age
¦
age: anInteger
    age := anInteger
¦
job
    ^job
¦
job: aSymbol
    job:=aSymbol
]
```

Fig 4 Example Little Smalltalk class definition

Factorial

Using 'self', Smalltalk methods can easily call themselves recursively. The resulting code is quite straightforward. Fig 3 shows the Smalltalk-80 code for a method that calculates the factorial of a number. It makes use of the 'self' pseudo-variable.

Here's show it works: the first line defines the method name — this method will respond to the unary message selector 'factorial'. Line 2 asks if 'self' is greater than 1. The result of sending the binary message selector '>' with argument 1 to 'self' will be an object — either 'true' or 'false'. The 'ifTrue:' keyword message selector will then be sent with an argument that is the block of code on line 3. If 'self' is greater than 1, the object will be 'true' and the block will get executed.

The block reads as return (^) the value of 'self' multiplied by the value of evaluating 'self' minus 1 factorial. The last expression is the recursive invocation of the factorial method with a new argument: 'self' minus 1.

The Smalltalk precedence rules say that unary messages get sent first, binary messages second, and keyword messages last of all. So the parentheses

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are necessary to ensure that 'self' minus 1 gets sent before the factorial message gets sent. Without them, the method would be syntactically correct — it just wouldn't work (try it!).

Lines 4 and 5 implement the base case test for the recursion. If the factorial method is called with argument '1', then just return the factorial of 1 — that is, 1. The final line is an error check — if it is ever executed then the argument to the factorial method must have been negative: which is a bad idea. The 'error:' message is implemented in class Object, so it is inherited and understood by all objects. It displays its argument string to the user in the form of an error message.

Cascaded messages

If you are sending a sequence of messages to the same object, Smalltalk has a shorthand message expression notation called a cascade. The receiver appears at the left-hand side of the expression as usual, but to the right can be an arbitrary sequence of message expressions separated by semicolons.

For example, the statements:

```
|aPen|
aPen := Pen new.
aPen up.
40' "
aPen light Grey.
40' "
```

can be replaced with:

```
|aPen|
  aPen := new; up; 40'; light Grey;
     40'
```

aPen is the receiver for the sequence of message expressions that are separated by semicolons. Little Smalltalk differs from this in how values are returned from a cascaded expression.

Messages to classes

In Smalltalk, messages are sent to ob-

```
Object subclass: #Connector
  instanceVariableNames:
    'name value notifier constraints'
  classVariableNames: ''
  poolDictionaries: '' !
!Connector class methods !
new
        ^super new initialise! !
!Connector methods !
connect: aNewConstraint
        (constraints includes: aNewConstraint)
                ifFalse: [constraints add: aNewConstraint].
        self hasValidValue ifTrue: [aNewConstraint newValue]!
forgetValue: sender
        sender = notifier
                ifTrue:
                        [notifier:=nil.
                         constraints do: [:aConstraint |
                             aConstraint ~= sender ifTrue:
                             [aConstraint forgetValue].
                          ]].!
hasValidValue
        ^notifier~=nil!
initialise
        value:=nil.
        notifier:=nil.
        constraints:=OrderedCollection new!
name
    ^name!
name: aName
    name:=aName!
value
        notifier=nil
            ifTrue: [^'?']
            ifFalse: [^value]!
value: aValue notifier: sender
        notifier = nil
                ifTrue:
                        [value := aValue.
                        notifier := sender.
                        constraints do:
                                [:aConstraint | aConstraint =
                                sender ifFalse: [aConstraint newValue]]]
                ifFalse:  [aValue ~= value ifTrue:  [self  error:
                        Conflict -- cannot set value']].
        ^value! !
Object subclass: #Constraint
  instanceVariableNames:
    'input1 input2 output'
  classVariableNames: ''
  poolDictionaries: '' !
!Constraint class methods ! !
!Constraint methods !
forgetValue input1 forgetValue: self.
            input2 forgetValue: self.
            output forgetValue: self.
            self newValue!
input1: c1 input2: c2 output:c3
        input1:=c1.
        input2:=c2.
        output:=c3.
        input1 connect: self.
        input2 connect: self.
        output connect: self!
newValue self subclassResponsibility! !
Constraint subclass: #Adder
```

```
!Multiplier methods !
newValue ((input1 hasValidValue and: [input1 = 0])
                or: [input2 hasValidValue and: [input2 = 0]])
                ifTrue: [^output value: 0 notifier: self].
        (input1 hasValidValue and: [input2 hasValidValue])
                ifTrue: [^output value: input1 value * input2
                        value notifier: self].
        (input1 hasValidValue and: [output hasValidValue])
                ifTrue: [^input2 value: output value / input1
                        value notifier: self].
        (input2 hasValidValue and: [output hasValidValue])
                ifTrue: [^input1 value: output value / input2
                        value notifier: self]! !
Constraint subclass: #Subtracter
  instanceVariableNames: ''
  classVariableNames: ''
  poolDictionaries: '' !
!Subtracter class methods ! !
!Subtracter methods !
newValue (input1 hasValidValue and: [input2 hasValidValue])
                ifTrue: [^output value: input1 value - input2
                        value notifier: self].
        (input1 hasValidValue and: [output hasValidValue])
                ifTrue: [^input2 value: output value + input1
                        value notifier: self].
        (input2 hasValidValue and: [output hasValidValue])
                ifTrue: [^input1 value: output value + input2
                        value notifier: self]! !
Constraint subclass: #Divider
  instanceVariableNames: ''
  classVariableNames: ''
  poolDictionaries: '' !
!Divider class methods ! !
!Divider methods !
newValue (input1 hasValidValue and: [input1 = 0])
                ifTrue: [^output value: 0 notifier: self].
        (input2 hasValidValue and: [input2 = 0])
                ifTrue: [^self error: 'Attempt to divide by 0'].
        (input1 hasValidValue and: [input2 hasValidValue])
                ifTrue: [^output value: input1 value / input2
                        value notifier: self].
        (input1 hasValidValue and: [output hasValidValue])
                ifTrue: [^input2 value: output value * input1
                        value notifier: self].
        (input2 hasValidValue and: [output hasValidValue])
                ifTrue: [^input1 value: output value * input2
                        value notifier: self]! !
  instanceVariableNames: ''
  classVariableNames: ''
  poolDictionaries: '' !
!Adder class methods ! !
!Adder methods !
newValue (input1 hasValidValue and: [input2 hasValidValue])
                ifTrue: [^output value: input1 value + input2
                        value notifier: self].
        (input1 hasValidValue and: [output hasValidValue])
                ifTrue: [^input2 value: output value - input1
                        value notifier: self].
        (input2 hasValidValue and: [output hasValidValue])
                ifTrue: [^input1 value: output value - input2
                        value notifier: self]! !
Constraint subclass: #Multiplier
  instanceVariableNames: ''
  classVariableNames: ''
  poolDictionaries: '' !
!Multiplier class methods ! !
```

Fig 5 Smalltalk/V class definitions for the Constraint network classes

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jects that are instances of some class. As you may have noticed in some of the examples, it is also possible to send messages to classes themselves (look, for example, at the 'new' message to Class Pen in the cascade example above). These messages to classes are usually used to create new instances of objects. But classes can actually respond to any messages for which the programmer chooses to implement methods.

Messages to classes can be used to provide examples of how to use a class or perform custom initialisation of variables. But this poses a philosophical problem: where should these messages be implemented? Smalltalk adopts the solution that classes are objects too. But what is the class of a class? In Smalltalk-80 and ST/V, each class is the sole instance of a special class and is known as a metaclass.

Little Smalltalk, preferring to keep life simple, does not implement the general notion of a metaclass. Instead, in Little Smalltalk, all classes are instances of class Class and the Little Smalltalk programmer cannot add to or change the set of methods implemented in Class. In other words, you cannot add to the set of messages that classes understand in Little Smalltalk.

Don't worry if this idea of meta-classes does not seem very easy to understand. Metaclasses were necessary to make the system 'work right' but are not the best feature of Smalltalk. Most of the time you are not aware of their existence, and unless you want to change how Smalltalk works you should not encounter them.

You do have to remember the distinction between messages to objects and messages to classes. When you are defining classes you typically implement most of the methods as messages to instances of the class but on occasion you might want to implement messages to the class. The set of messages that instances of a class understand is called the class's 'instance protocol'; the set of messages to the class itself the 'class protocol'.

Smalltalk class definitions

Smalltalk class definitions let you add new classes of objects to the system. A class definition has to specify the name of the class, what the parent or superclass of the class is, the structure of objects that are instances of the class, what variables are accessed by the class, and the set of methods implemented by the class.

Classes capture what is similar between all the objects that are instances of the same class. One way to think of class definitions is as 'type' definitions as in Pascal or C, but this is not the full story and can be a bit misleading. Classes define both a state component (instance variables, class variables, pool variables . . .) and a procedural component (the methods that implement the messages to which an instance of that class will refer). They are more like modules.

There are some differences in the handling of class definitions between Smalltalk-80, ST/V and Little Smalltalk. Fig 4 shows the original Class Person used in part 1 as it would be defined in Little Smalltalk.

As mentioned above, class definitions provide a template for the creation of new instances of objects of that class. A class definition will specify the name of the superclass of the class. In Class Person the superclass is class Object. So instances of Class Person will inherit the methods (and in Smalltalk-80/ST/V the instance variables) of class Object. According to the class definition, objects of Class Person will have three instance variables named name, age, and job. There are no class, or pool variables used. Class Person defines a number of methods. These define the set of messages we can send to Person objects.

There is no distinction between the built-in classes, that come with the system, and the classes you define yourself. Instances of Class Person can be stored in the Collection classes, passed around as arguments to methods and so forth.

Let us consider as an example the case of bi-directional computing. Like most programming languages Smalltalk statements are one way. If you have the formula for the gradient of a line: y=mx+c then you can find y in terms of m, x, and c with the statement: y:=m*x+c but you cannot use the same statement to find x, in terms of m, c, and y.

One way out of this is to use a constraint network. A constraint network lets you model computations in terms of relationships (called constraints) between different quantities. With a constraint network that represents y=mx+c you can find the value of any term, given the other three.

To represent constraint networks in Smalltalk, we need to represent the constraints *plus* the links between the different constraints — called connectors. If we implement a sufficiently general solution then we will have a toolkit that can be used to create constraint networks for other expressions as well. Since visualising networks of constraints is hard work, we might also like to be able to display the network graphically.

To represent y:=m*x+c we need to have two constraint objects — a multiplier constraint object that takes two inputs (m and x) and multiplies them to produce an output product; and an adder constraint object which takes two inputs (c and the result of the multiplier) and produces the addition as output. We also need five connector objects to connect the two constraints and provide a way of getting values in and out of the network.

Given the appropriate class definitions, these are the Smalltalk statements that create the network:

```
"Create a constraint network that
  represents y=mx+c"

|anAdder aMultiplier y m x c p|

anAdder:=Adder   "Create an adder
    new.               constraint"

aMultiplier:=     "Create a
    Multiplier          multiplier
    new.                constraint"
y:=Connector      "Create
    new.              connectors"
m:=Connector
    new.
x:=Connector
    new.
c:=Connector
    new.
p:=Connector       "p holds the pro-
    new.              duct of the *"
aMultiplier input1: m input2: x out-
   put: p. "link up connectors and
   constraints"
anAdder input1: p input2: c output:
   y.
```

Having done this, we can set some of the connector objects to certain values:

```
m value: 4 notifier: #fromUser. "set
   m to 4"
x value: 5 notifier: #fromUser. "set x
   to 5"
c value: 7 notifier: #fromUser. "set c
   to 7"
y value "and enquire the value of y"
evaluates ?=(4*5)+7 to give: y=27.
```

Now, if we ask one of the connectors to forget its value:

```
c forgetValue: #fromUser
```

and enquire the value of y:

```
y value
```

we get '?' We no longer know the value of y.The constraints are not satisfied.

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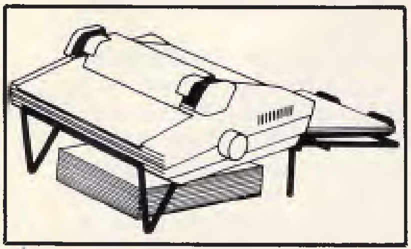

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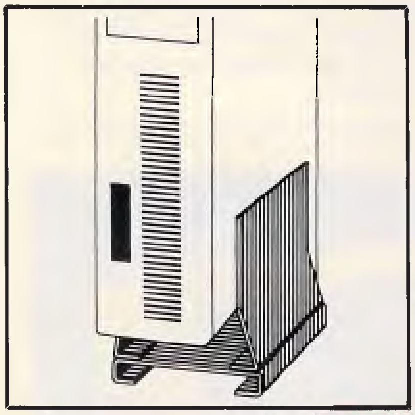

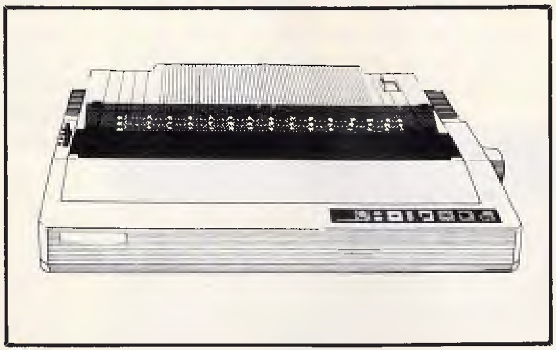

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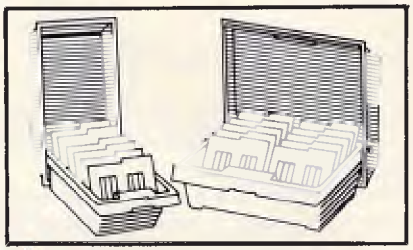

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But we can set the value of y:

y value: 32

and enquire the value of c:

c value

the result is 12 (32=4★5+?).

Fig 5 illustrates the Smalltalk/V class definitions for the Constraint network classes.

Class Connector is a subclass of Object. It has four instance variables: value, the current value of the connector; notifier, the object that sets the current value of this connector (or nil if not set); constraints, the set of constraints that are connected to this connector; and name, which lets the user name a particular connector with a descriptive string. Class Connector implements nine different methods — one class method which ensures that newly created connectors are properly initialised, and eight methods for manipulating the connectors.

Class Constraint is an abstract superclass that represents what is common to its subclasses — Classes Adder, Subtracter, Multiplier and Divider. These are four types of Constraint that know how to add, subtract, multiply or divide two inputs and produce an output. There are three instance variables — input1, input2, and output that store the connectors linked to this constraint. Class Constraint implements three methods for Constraint objects. The first two, forgetValue: and connect:, are inherited and used unmodified by the subclasses. The last method, newValue, does nothing but is redefined in each subclass to carry out the computation appropriate to this class of Constraint.

END

Next month: *adding to and displaying the constraint network; Smalltalk graphics and the interactive programming environment.*

Homework

Devise and test a constraint network for the formula a=b★c+d/e. Constraint networks can represent many kinds of problem. How could the system be extended with additional kinds of constraint?

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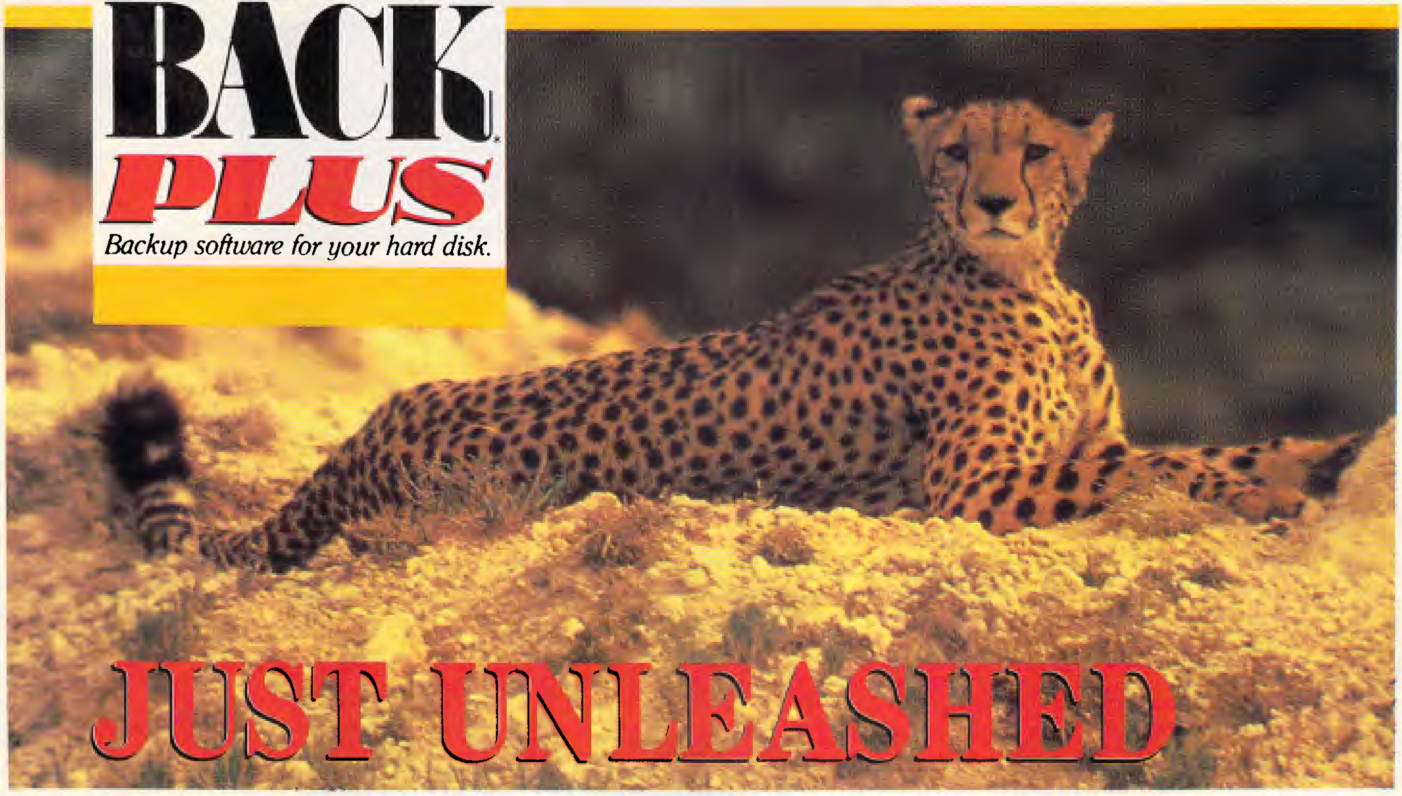

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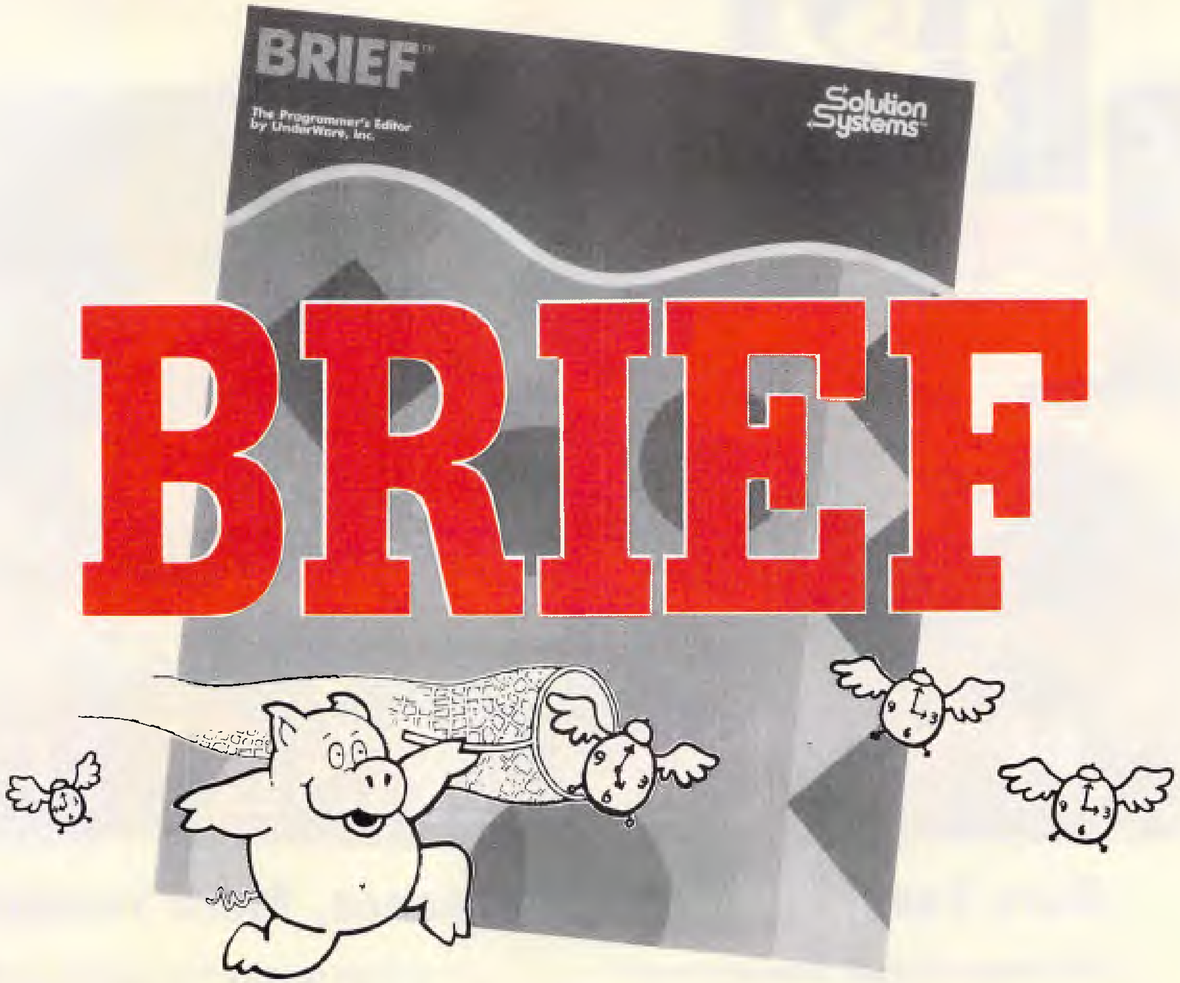

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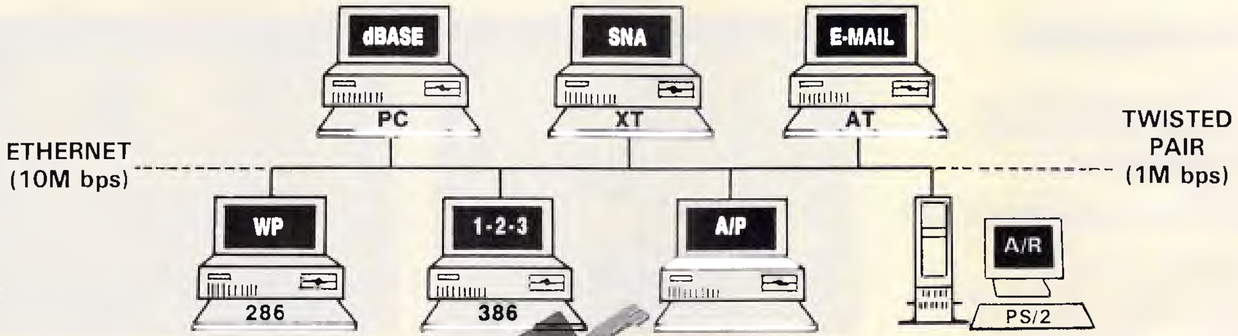

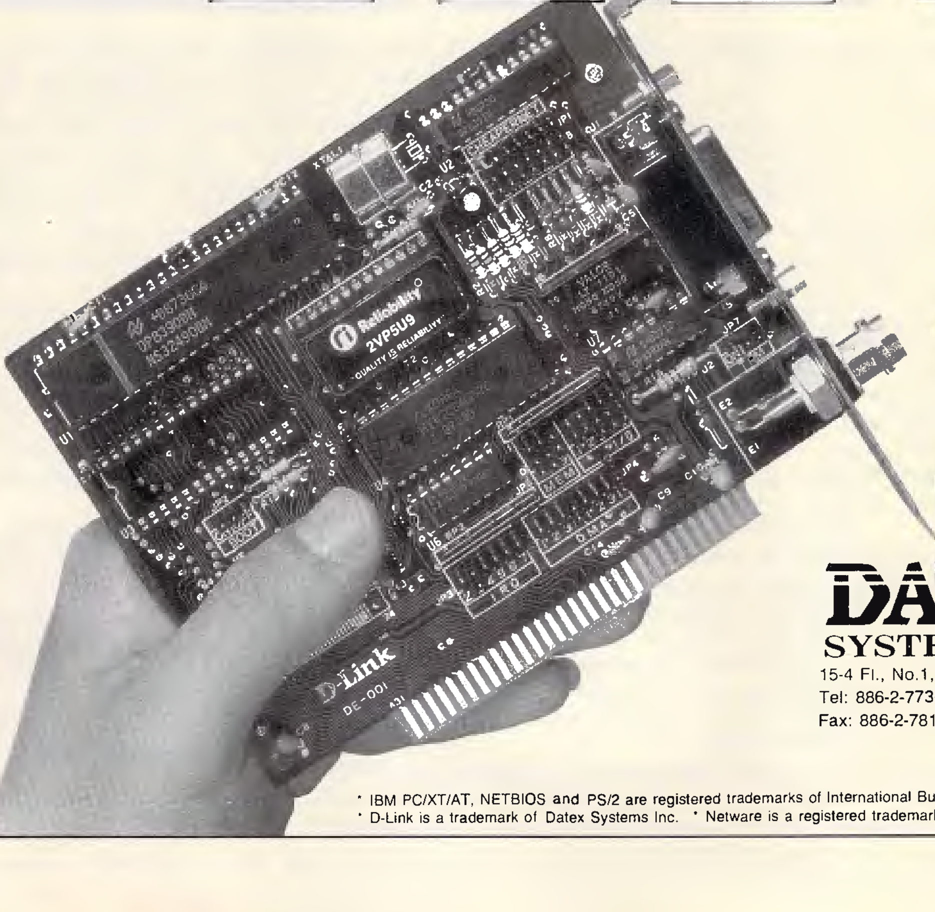

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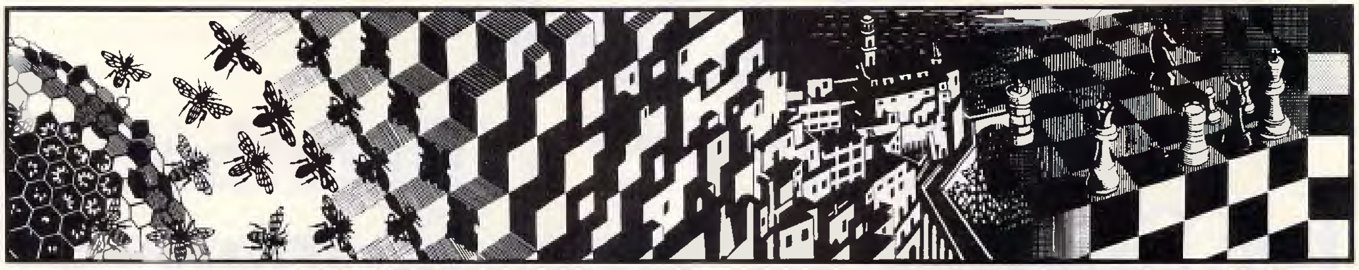


Normally we'd tell you exactly where to get the games reviewed in this section but, just as we were going to press, a distribution squabble broke out. So, 'Metropolis' is temporarily unavailable. Call Melbourne-based distributor, ISD, for reports on how the battle is progressing. Meanwhile let's get on with some animal magnetism.

Animal magnetism

Title: Jinxter
Computer: Commodore 64/128, Amiga, Atari ST, Amstrad
Supplier: Imagineering
Format: Disk
Price: $60 (Commodore 64), $68 other

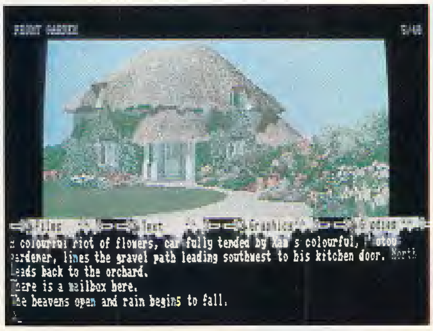
Will Magnetic Scrolls never put a foot wrong? After the runaway success of The Pawn and The Guild of Thieves, you would have thought that the company might have run out of inspiration.

But if its competitors were hoping that its latest game, Jinxter, was going to be the one where everything started to go wrong, they must be mortified. Far from being a step backwards, Jinxter is, incredibly, an improvement on its predecessors.

Jinxter is a humorous tale about strange goings-on in Aquitania, a mythical world full of bureaucrats and statisticians. Unfortunately for the people of Aquitania, the magical charm bracelet, bequeathed to them by the magician, Turani, and which brought them perpetual good luck, has had its charms stolen. Without its charms, the bracelet is useless, and Aquitania is helpless against the ill offices of the green witches and their evil leader, Jannedor.

Your objective is to recover the various charms and reassemble the bracelet, thus restoring its magic properties. You must then use the bracelet's power to defeat the noxious green witches.

If this *sounds* simple, it isn't. While the bracelet is without its charms, its magic gradually diminishes, causing you to have increasingly bad luck. Jinxter is unusual, therefore, in that it gets progressively more difficult the further you go.



```
A colourful riot of flowers, carefully tended by Xam's colourful, [illegible]
gardener, lines the gravel path leading southwest to his kitchen door. North
leads back to the orchard.
There is a mailbox here.
The heavens open and rain begins to fall.
>_
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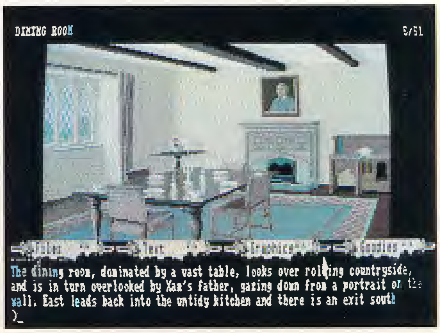


```
The dining room, dominated by a vast table, looks over rolling countryside,
and is in turn overlooked by Xam's father, gazing down from a portrait on the
wall. East leads back into the untidy kitchen and there is an exit south
>_
```

Although a number of items which appear in the adventure could be mistaken for part of the bracelet, Magnetic Scrolls has prevented any possibility of this happening by including pictures of the charms on the packaging and in the title screen, as well as informing you what they are in the Infocom-like bumph included with the game disk. However, apart from making the charms easier to identify, this does not help you find them.

All the charms have magic spells attached to them, which can be cast by saying the name of the charm. The spells include ones to make it rain, to make the sun come out, and to make things come to life. Each one of these comes in useful at some point, no doubt, though I have yet to discover where.

Throughout the adventure, you are watched over by a benevolent spirit called Len Wossname. He is one of the 'Guardians', whose job it was to protect the bracelet. Wossname, like all Guardians, cannot express his thoughts in words, and continually calls things by the wrong names. When he talks about the charms, for instance, he rambles on about the 'thingy' (dragon), the 'doodah' (fire engine), the 'oojimy' (walrus) and the 'doofer' (pelican).

A short insight into Wossname's speech appears in a phoney newspaper supplied with the game. Apart from being fairly amusing, this rag contains numerous clues and ciphered hints which can be keyed in and deciphered when things get really rough.

Humorous dialogue has always been a feature of Magnetic Scrolls' adventures, but in Jinxter the writers have gone overboard. When Wossname introduces himself, he does so in a way that reads like a snippet from *Monty Python*: 'You wouldn't believe I was an Immortal, would you?' he says. 'You wouldn't look at me and say: "Stone me, a bleeding immortal being, God-like in his majesty"?'

Inspecting a wall for clues produces a rather sarcastic reply, which takes up the best part of a screen, and ends: 'Thinking on the role of walls in your life, you eventually enter a trance-like state which the mystics of the Orient call "Nirvana" and the rest of us call "idiocy".'

Amusing as much of this is, the constant stream of rather laboured jokes eventually becomes rather tedious, and you begin to wish that the program's writers had not been such a happy bunch.

Like the Kerovnian adventures, Jinxter contains many superb graphic illustrations designed to complement the rich prose. These are far better than those in either The Pawn or The Guild of Thieves, which is quite an achievement. Only the first picture, depicting the inside of a crowded bus, lets the graphics down, simply because the passengers look like zombies. Then again, perhaps that was the artist's intention.

Magnetic Scrolls, like Infocom, hides its game disks among a mass of bits and pieces which, for some reason, are considered terribly important. Games companies seem to assume that their adventures are incomplete if they don't provide some useless free gift which most people probably discard soon after they have opened the package.

With Jinxter, then, you get a copy of *The Independent Guardian* newspaper, a beer mat, and an enveloped memo containing an outline of the story. I was pleased with this last item — it replaces the turgid novella which Magnetic Scrolls usually includes with its adventures. We should be thankful for small mercies, I suppose.

As well as excellent graphics, Amiga owners are treated to an opening tune on their version of Jinxter, a swirling piece of fairground music. Sadly, the Atari version of the game is a non-musical affair.

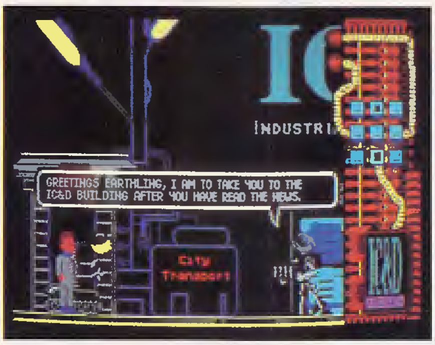
Jinxter is the natural successor to The Pawn and The Guild of Thieves. I am pleased to see that Magnetic Scrolls has not rested on its laurels. It would have been easy for the company to produce an inferior program and counter-attack by challenging people to write a better program than either of the aforementioned two. But it has not done this. Instead, it has produced an adventure that sparkles on every level. Once again, I look forward to Magnetic Scrolls' next production.

Broken English

Title: Metropolis
Computer: IBM PC
Supplier: N/A
Format: Disk
Price: N/A

If you remember Eliza, the program shell that was supposed to enable a computer to hold an intelligent discourse with a human being, you will know that intelligent was something it was not. A programmer has recently written an ambitious game, Metropolis, which uses an Eliza-type parser to allow you to talk directly to its characters in natural English. Unfortunately, though not altogether surprisingly, the computer I played Metropolis on had a very strange idea of what constitutes natural English, so its replies were not always what one would expect. Inanities are, it seems, still the major constituent of computer talk.

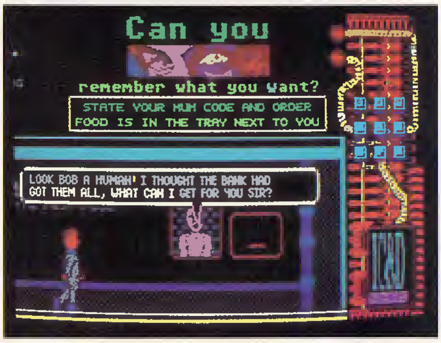
Metropolis is a detective yarn, set in a futuristic city that looks like the backdrop from a *Blade Runner* outtake. You are in Metropolis to track down the master tape of a new super-game, stolen from your company, IC&D, by a rival software house. The jokes and allusions are, as implied by the brief summary, all very 'in'; if you are not familiar with computer industry gossip or the pioneers of computing, you won't fully appreciate everything that goes on in the game.



GREETINGS EARTHLING, I AM TO TAKE YOU TO THE IC&D BUILDING AFTER YOU HAVE READ THE NEWS.

Getting about Metropolis usually involves walking, though for long journeys you can use public transport and something called the 'ZoomTube'. First, though, you must convince a rather pedantic droid that you know inside out the rules for using the ZoomTube. Even though most of the world's evils have been eradicated in this futuristic fantasy, bureaucracy remains as rife and as pernicious as ever.

Clues, apparently, are thick on the ground, but I couldn't find any that were obvious. Not even the newsflashes that frequently appear on the right of the display helped much. These newsflashes are vital to the game because they tie events together and push the story along. As events happen in other parts of the city, they are picked up by the TV stations and broadcast immediately. There is supposed to be a sub-plot concerning a tiff between the various news channels of Metropolis, but I didn't get that far into the game.



STATE YOUR MUM CODE AND ORDER
FOOD IS IN THE TRAY NEXT TO YOU

LOOK BOB A HUMAN! I THOUGHT THE BANK HAD GOT THEM ALL, WHAT CAN I GET FOR YOU SIR?

Metropolis is simply an abundance of gimmicks, loosely linked by an incoherent storyline. As far as they go, though, the gimmicks are extremely well done. The animated graphics, for instance, are certainly some of the best I have seen on a PC. Your detective character, a podgy, raddle-faced man in a natty jumpsuit, walks across the screen, nonchalantly swinging his arms. Various robots and droids do much the same thing; they, however, seem to be little more than extras who are there only so that you can stop them for a conversation. Some have useful information which they will gladly divulge — if you can find the phrases that will trigger the desired responses.

Another interesting feature of Metropolis is the speech; not the onscreen dialogue which appears in speech-bubbles, but the synthesised speech which pours through the computer's speaker when a character is talking. This is under total software control, and can be speeded up, slowed down or turned off, all from within the game via the keyboard.

Metropolis, for all its fancy features, is flawed through want of a good scenario. It is an ambitious project that has not quite succeeded. All credit to the game's programmer for having done everything, including the graphics, himself. In spite of his enthusiasm, though, it just doesn't grab your attention sufficiently to warrant a return visit.

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ASPRN cures laser printer headaches

Sending long Escape sequences to control laser printers is a pain at best and impossible for many word processors. This macro processor inserts the codes right in printer output.

Printers are a wonderful, often mysterious part of our computing experience, but none are more wonderful and mysterious than the laser variety. Coupled with a laser-aware word processor, a laser printer can produce page after page of letter quality output, making even the simplest notes and memos more attractive.

A laser printer, however, requires a large investment, and chances are that you will call it into service both as an intelligent peripheral for your word processor and as a simple draft printer. Even simple tasks can stand some enhancement. Assembly listings, for example, look great using the line printer font printed 132 columns wide across the long dimension of the page. And often I'd like to dash off a note using my Times Roman font without the bother of firing up WordPerfect.

I know that in theory you can do this simply by sending some codes to the printer. Ever the practical man, however, I took one look at the programming manual for my laser, filled with page after page of cryptic Escape codes, and then decided I really preferred 10-pitch Courier type in portrait mode. As a monument to creative laziness, I wrote ASPRN, a utility that lets you spend more of your time putting information on paper, and less time worrying about how it gets there.

Macros for your printer

ASPRN is a printer-output macro expander that works somewhat like a keyboard macro processor in that it lets you substitute a simple keystroke for a complex sequence. For example, to dash off a simple one-page memo, you might ordinarily have to enter a complicated control string to turn bold on, another to switch type styles, and yet another to get back to normal. Even if you could memorise all those control strings and you could enter the necessary escape codes directly in the program you've used to create a file, such a keypecking procedure is just too much like work.

Imagine instead being able to enter ~B to turn on bold, ~I to turn on italics, and ~N to return to normal. Sound better? Well, that's exactly how ASPRN operates. But rather than sending these codes to your printer immediately like a setup utility, ASPRN lets you embed them in your document where they will be expanded at print time. It lets you specify up to 26 macros — a macro being defined as a user-selected character followed by a single letter. When a document that contains a macro is printed, ASPRN intercepts the two-character combination on its way to the printer and substitutes the long control string assigned to the macro.

Both the assembly language-source code (ASPRN.ASM) and a Basic program that will create ASPRN.COM when you run it (ASPRN.BAS) are printed elsewhere in this article. The easiest way to get a copy of either of them, however, or to get a fully assembled, ready-to-run ASPRN.COM, is to download it from Microtex on Telecom's Viatel (see page *6663#) or by sending a stamped, self-addressed package to ASPRN, c/- *APC*, 124 Castlereagh Street, Sydney 2000.

Prescribing ASPRN

Though not a large program (it weighs in at just over 2300 bytes), ASPRN is quite flexible and has a number of uni-

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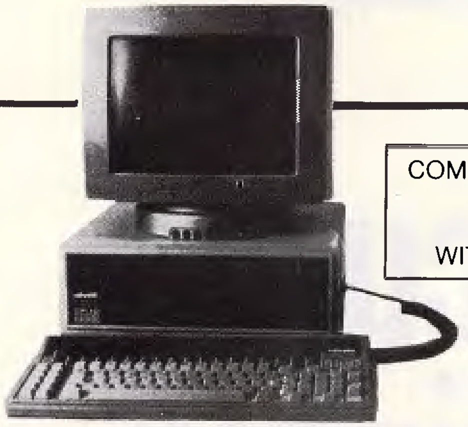

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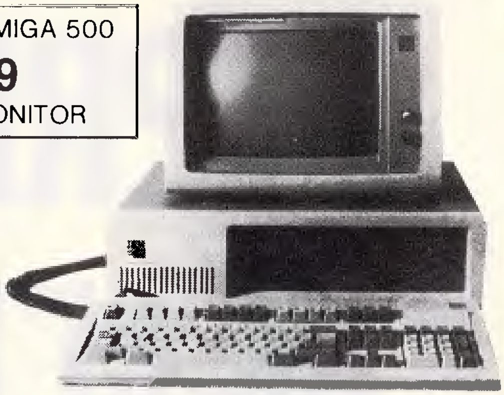

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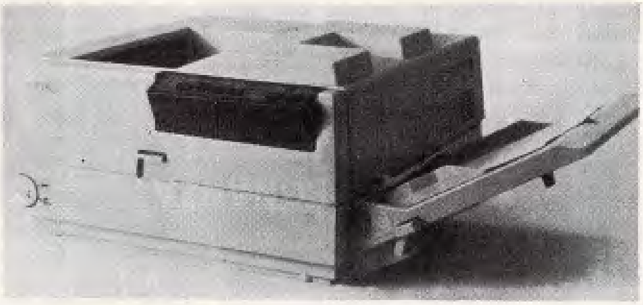

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que features. ASPRN is a memory-resident program that sits between your regular programs and your printer and allows you to send control strings of nearly unlimited size almost effortlessly. While designed specifically with laser printers in mind, ASPRN can communicate with any dot matrix or letter quality printer just as effectively.

The program itself is fully configurable. Several useful printer enhancement programs contain a number of simple, predetermined printer control sequences, and if that were all ASPRN allowed, it would be neither exciting nor unique. Instead, each of the 26 people control strings can be entered, edited, and saved. A string may also be given a clear descriptive name, like Times Roman Bold Italic, to make identification easier. And rather than forcing you (or DOS) to hunt for a separate file that contains your definitions, when you make updates and changes, ASPRN writes a new version of itself back to disk as a single, self-contained .COM file.

Initialising ASPRN

As written, ASPRN contains 26 empty control strings; if you just loaded it, it would simply absorb the macro combinations and perform no useful work. The first step, therefore, is to fill at least one of the empty macro slots with the control string it will represent. If you're reaching for DEBUG, stop! ASPRN comes with a fully functional line editor that lets you enter and modify complicated control sequences and normally nonprinting characters, including the ESC character. The editor is built in and is invoked with the /S command-line switch. Simply enter

```
ASPRN /S
```

to load the program in setup mode and bring up the editor.

As depicted in the accompanying diagram 'ASPRN Edit Window', the window contains three major areas of interest: the macro character sequence, the descriptive macro name, and the macro string itself. The macro sequence, which is shown on the first line, is the two-character combination that, when sent to the printer, causes the string shown on the third line to be transmitted in its place. As the program is written, the default macro character is the tilde (~), but this can easily be changed to a character of your choice. (For the sake of this discussion, I'll stick with using the tilde.)

The second line is provided to let you give the string a descriptive name. The name may be as long or as short as you like, so you can use this space for comments to help you remember what a sequence you've entered does.

```
        TITLE   ASPRN - Printer Macro Expander
        PAGE    60,132
;=======================================================================
;
;  ASPRN - A printer macro expansion utility.  A TSR that watches INT 17
;  and looks for an escape sequence of the form (char)x where x=(A-Z) and
;  expands it to a setup string.  Clones itself to include changes in
;  the COM file.  Different macro charactars act like different programs.
;
;       Usage: ASPRN [ /U | /S ][ /Mx | /Cnnn ]
;
;=======================================================================

CSEG    SEGMENT PARA PUBLIC 'CODE'
        ASSUME  CS:CSEG,DS:NOTHING,ES:NOTHING,SS:NOTHING

;-----------------------------------------------------------------------
;  Some common equates.
;-----------------------------------------------------------------------

CR              EQU     13                              ;Common equates
LF              EQU     10

INS             EQU     52H                             ;Extended ASCII values
DEL             EQU     53H
F7KEY           EQU     41H
HOME            EQU     47H
ENDKEY          EQU     4FH
PGUP            EQU     49H
PGDN            EQU     51H
RARROW          EQU     4DH
LARROW          EQU     4BH
UARROW          EQU     48H
DARROW          EQU     50H
BS              EQU     0E08H                           ;Scan/Ascii code
U_SW            EQU     1                               ;Request to Uninstall
S_SW            EQU     2                               ;Do a Setup
M_SW            EQU     4                               ;Change Escape char
ERR_SW          EQU     0FFH                            ;General error

;-----------------------------------------------------------------------
;  Start of code.
;-----------------------------------------------------------------------
                ORG     100H                            ;Starting offset for COM
ENTPT:          JMP     INITIALIZE                      ;Skip over resident code


ESC_CHAR        DB      "~"                             ;Escape char used as part
                                                        ; of program signature

COPYRIGHT       DB      "ASPRN 1.0 (c) 1988 Ziff Communications Co.",CR,LF
                DB      "PC Magazine ",254," Robert L. Hummel",CR,LF,"$",26

OLD_INT17       DW      0,0                             ;Store old vector here

;-----------------------------------------------------------------------
;  A Far Pointer is kept to point to strings so they can be found anywhere
;  in memory.  The length of strings is here as well.  These are updated
;  when a modified copy is written to disk.
;-----------------------------------------------------------------------

STRING_LOC      DW      OFFSET STRINGS,0
STRING_LEN      DW      OFFSET STRING_END - OFFSET STRINGS


;=======================================================================
;  MACRO EXPANDER - This portion stays resident and is loaded only once.
;  Each time a character is output to the printer, check to see if it is
;  our escape char.  If so, don't send it.  The next char will indicate
```

```
;  which string to send in it's place.  If two escape chars are sent in
;  a row, print one copy of the escape char.
;-----------------------------------------------------------------------

ESC_FLAG        DB      0                               ;=1 if last was Esc-char
PANIC_FLAG      DB      0                               ;Non-zero in emergencies

INT17           PROC    FAR
        ASSUME  CS:CSEG,DS:NOTHING,ES:NOTHING,SS:NOTHING

                CMP     CS:PANIC_FLAG,0                 ;If panic flag
                JNE     INT17_0                         ; do nothing

                STI                                     ;Allow interrupts
                OR      AH,AH                           ;If print char function
                JZ      INT17_1                         ; check for ESC_CHAR
INT17_0:
                CLI                                     ;Disable intarrupts
                JMP     DWORD PTR CS:OLD_INT17  ;Else, continue
INT17_1:
                CMP     CS:ESC_FLAG,0                   ;Was last char esc?
                JNE     INT17_2                         ;Yes, go expand

                CMP     AL,CS:ESC_CHAR                  ;Is this an esc_char
                JNE     INT17_0                         ;No, just print it

                INC     CS:ESC_FLAG                     ; else, set latch
INT17_1A:
                MOV     AH,2                            ;Get status instead
                JMP     INT17_0                         ; from original interrupt
INT17_2:
                MOV     CS:ESC_FLAG,0                   ;Clear latch
                CMP     AL,CS:ESC_CHAR                  ;If second esc_char
                JE      INT17_0                         ; output single char

                OR      AL,20H                          ;Make lower case
                SUB     AL,"a"                          ;Convert to 0-25
                CMP     AL,25                           ;Must be in range
                JA      INT17_1A                        ; else ignore

                CALL    EXPAND                          ;Exand the macro
                JMP     INT17_1A                        ;Exit with status call

INT17           ENDP


;=======================================================================
;  Expand the macro for this string combination.  Enter with AL = string
;  number (must be 0-25).  DX = printer number (from original int).
;-----------------------------------------------------------------------
EXPAND          PROC    NEAR
        ASSUME  CS:CSEG,DS:NOTHING,ES:NOTHING,SS:NOTHING

                PUSH    DS                              ;Saved used registers
                PUSH    SI
                PUSH    CX

                LDS     SI,DWORD PTR STRING_LOC ;Point DS:SI to strings
                MOV     CL,AL                           ;Each macro occupies two
                ADD     CL,CL                           ; strings, so double
                INC     CL                              ; and add one
EXP_0:
                OR      CL,CL                           ;If at selected string
                JZ      EXP_2                           ; copy it to printer
                DEC     CL                              ;Adjust counter
EXP_1:
                LODSB                                   ;Find the string end
                OR      AL,AL                           ;If not terminating zero
                JNZ     EXP_1                           ; continue to read string
                JMP     EXP_0                           ;Else find next string
```

Listing 1: The assembly language source code for ASPRN.COM

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```
EXP_2:
                LODSB                           ;Get a char
                OR      AL,AL                   ;At end of string?
                JZ      EXP_3                   ;Yes, exit
                PUSHF                           ;No, simulate INT 17h
                XOR     AH,AH                   ; print the character
                CALL    DWORD PTR CS:OLD_INT17  ; through old int
                CMP     AH,10h                  ;Check return status
                JE      EXP_2                   ; continue if no error
EXP_3:
                POP     CX                      ;Restore used registers
                POP     SI
                POP     DS
                RET                             ;And return

EXPAND          ENDP

;----------------------------------------------------------------------
;  This is the smallest amount of the program that can remain in memory
;  and still function.
;----------------------------------------------------------------------

MINIMUM         EQU     $

;----------------------------------------------------------------------
;  SHRIVEL is really the part of INITIALIZE that makes sure we use as
;  little memory as possible by relocating the strings downward.
;----------------------------------------------------------------------
SHRIVEL         PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:NOTHING, SS:NOTHING

                CLD                             ;String moves forward

                MOV     SI,OFFSET STRINGS       ;Source of strings
                MOV     DI,OFFSET CUTOFF        ;Destination
                MOV     CX,STRING_LEN           ;Number bytes to move

                MOV     STRING_LOC[2],ES        ;New segment of strings
                MOV     STRING_LOC[0],DI        ;New offset

                MOV     DX,CX                   ;Save length of strings
                ADD     DX,DI                   ; add to program length

                REP     MOVSB                   ;Move DS:SI to ES:DI

                ADD     DX,15                   ;Round to nearest paragraph
                MOV     CL,4                    ;Convert to paras
                SMR     DX,CL                   ; by dividing
                MOV     AX,3100H                ;Terminate & stay resident
                INT     21H                     ; thru DOS

SHRIVEL         ENDP

;----------------------------------------------------------------------
;  When terminating for the first time, the SHRIVEL proc must be left
;  resident to do the dirty work.  Everything after CUTOFF is discarded
;  or written over by the strings.
;----------------------------------------------------------------------

CUTOFF          EQU     $

;----------------------------------------------------------------------
;  The INITIALIZE procedure performs most of the work.  It interprets
;  the command line switches, checks for previous copies, and does all
;  the memory management.  Entry is via JMP.
;----------------------------------------------------------------------
NOT_RES$        DB      "Not Resident$"
CANT_GO$        DB      "Cannot Uninstall$"
SYNTAX$         DB      "Usage:  ASPRN [ /U | /S ][ /Mx | /Cnnn ]$"


INITIALIZE      PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:CSEG, SS:CSEG

;----------------------------------------------------------------------
;  Set up a local stack at the end of the program.
;----------------------------------------------------------------------
                CLI                             ;Disable interrupts
                MOV     SP,OFFSET STACK_TOP     ;SS:SP points to stack
                STI                             ;Allow interrupts

;----------------------------------------------------------------------
;  Display the copyright notice.
;----------------------------------------------------------------------
                MOV     DX,OFFSET COPYRIGHT     ;Say who we are
                MOV     AH,9                    ;Display string function
                INT     21H                     ; Thru DOS

;----------------------------------------------------------------------
;  Release the copy of the environment allocated to this program.  The
;  segment address of the env block is located at offset 2Ch in the PSP.
;----------------------------------------------------------------------
                PUSH    ES                      ;Save register

                MOV     BX,WORD PTR DS:[2CH]    ;Get environment segment
                MOV     ES,BX                   ; in ES
        ASSUME  ES:NOTHING
                MOV     AH,49H                  ;Free allocated memory
                INT     21H                     ; Thru DOS

                POP     ES                      ;Restore register

        ASSUME  ES:CSEG

;----------------------------------------------------------------------
;  The CMD_LINE procedure looks for switches on the command tail and
;  returns them bit-packed in AH.
;
;  /S (Setup) will invoke the editor and allow changes to be made to the
;       loaded copy and written out to disk.  No changes are made to the
;       resident copy if one exists.
;  /Mx (Macro char) will substitute the char x for the default escape
;       char.  If the /S parameter is specified, the char will be changed
;       in the loaded copy and written back to disk.  Otherwise, the char
;       is used to determine residency and operation characteristics.
;  /Cnnn (escape Char) Same as /E, but allows any char from 001-255 to
;       be specified as a decimal number.
;  /U (Uninstall) Will flush the resident copy if possible.
;       Otherwise, no action.  Other switches are ignored.
;----------------------------------------------------------------------
                CALL    CMD_LINE                ;Get switches in AH
                JNC     INIT_1                  ;If no carry, no error

                MOV     DX,OFFSET SYNTAX$       ;Show correct syntax
INIT_0:
                MOV     AH,9                    ;Display string fn
                INT     21H                     ; Thru DOS

                MOV     AX,4C01h                ;Terminate with error
                INT     21H                     ; Thru DOS
INIT_1:
;----------------------------------------------------------------------
;  Process the flags.
;----------------------------------------------------------------------
                TEST    AH,U_SW                 ;Request to unload?
                JZ      INIT_2                  ;No, check next switch

                CALL    UNLOAD                  ;Unload if possible
                JC      INIT_0                  ;Carry set if error

                MOV     AX,4C00H                ;Terminate okay
                INT     21H                     ; Thru DOS
INIT_2:
                TEST    AH,S_SW                 ;Setup switch on?
                JZ      INIT_3                  ;No, check next option
                JMP     SETUP                   ;Yes, invoke the editor
INIT_3:
                CALL    FIND_RES                ;Look for resident copy
        ASSUME  ES:NOTHING                      ; ES may have changed

                JC      LOAD                    ;No copy found - try load
                JMP     REPLACE                 ; else, replace

INITIALIZE      ENDP


;----------------------------------------------------------------------
;  This procedure will cause the load copy of the program to become
;  resident.  The new copy will try to locate the strings as low in
;  memory as possible.  Hook the interrupt vectors, load the strings,
;  and TSR.  Entry via JMP.
;----------------------------------------------------------------------
LOAD            PROC    NEAR

        ASSUME  CS:CSEG, DS:CSEG, ES:CSEG


                PUSH    ES                      ;Preserve register
        ASSUME  ES:NOTHING                      ; Changed by next call

                MOV     AX,3517H                ;Get BIOS printer INT
                INT     21H                     ;Result in ES:BX

                MOV     OLD_INT17[0],BX         ;Save old vector
                MOV     OLD_INT17[2],ES         ; in local storage

                POP     ES                      ;Restore register
        ASSUME  ES:CSEG

                MOV     AX,2517H                ;Set new interrupt
                MOV     DX,OFFSET INT17         ; to us at DS:DX
                INT     21H                     ; Thru DOS

;----------------------------------------------------------------------
;  As loaded, ASPRN owns all memory from its PSP to the end of memory.
;  Thus the only memory an allocation call will find will be below us.
;  Try to find a low memory block to contain the strings.  If success,
;  AX contains segment of allocated block.  If no room is found, dump all
;  excess code and relocate strings downward.
;----------------------------------------------------------------------
                CALL    FIND_LOW                ;Look for lower block
                JNC     LOAD_1                  ;No carry if found

                JMP     SHRIVEL                 ;No room in low mem

;----------------------------------------------------------------------
;  A chunk of memory of suitable size was found below this program at
;  segment in AX. Relocate the strings to the new area.  DS:SI to AX:DI
;  Then TSR,leaving only the macro expander resident in this segment.
;----------------------------------------------------------------------
LOAD_1:
                CALL    MOVE_STRINGS            ;Move the strings

                MOV     DX,(OFFSET MINIMUM - OFFSET CSEG + 15) SHR 4
                MOV     AX,3100H                ;Keep process resident
                INT     21H                     ; Thru DOS

LOAD            ENDP


;----------------------------------------------------------------------
;  Read the command line.  Set flags in AH to indicate which switches
;  were included.  Note: the /M /C flags are eaten internally and are
;  set for ease of later modification.
;  0 = none, 1 = /U, 2 = /S, 4 = /M or /C and AL = x, and FF = error.
;  Return carry clear if valid, set if invalid.
;  Changes:     AX,BX,CX,DX,SI,DI
;----------------------------------------------------------------------
WHITE           DB      " ,;",9                 ;Space,comma,semi,tab
WHITE_LEN       EQU     $ - OFFSET WHITE


CMD_LINE        PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:CSEG

                XOR     DH,DH                   ;Accumulate flags here
                MOV     SI,80H                  ;Length of cmd line
                LODSB                           ;Get byte in AL
                OR      AL,AL                   ;If parameters
```

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```
                JNZ     CMD_1                           ; process them
CMD_0:
                CLC                                     ;Clear carry = no error
                MOV     AH,DH                           ;Load flags
                RET                                     ;Return
CMD_1:
;-----------------------------------------------------------------------
;  Something is on the line.  Let's find out what.
;-----------------------------------------------------------------------
                MOV     BL,AL                           ;Put char count in BL
CMD_2:
                OR      BL,BL                           ;Any more chars?
                JZ      CMD_0                           ;If not, exit

                LODSB                                   ;Get character in AL
                DEC     BL                              ;Adjust count
                MOV     DI,OFFSET WHITE                 ;Compare to those
                MOV     CX,WHITE_LEN                    ;Number to check
                REPNE   SCASB
                JE      CMD_2                           ;Jump if char was white

                CMP     AL,'/'                          ;Is the char a slash?
                JE      CMD_4                           ;Yes, process switch
CMD_ERR:
                MOV     AH,ERR_SW                       ;Signal error
                STC                                     ;Carry on
                RET                                     ;Return

;-----------------------------------------------------------------------
; char was slash.. Get and process switch in an inelegant fashion.
;-----------------------------------------------------------------------
CMD_4:
                OR      BL,BL                           ;Switch must follow /
                JZ      CMD_ERR                         ;If not, error

                LODSB                                   ;Get switch
                DEC     BL                              ;Reduce count
                AND     AL,NOT 20H                      ;Make switch upper case

                CMP     AL,"U"                          ;Request to uninstall
                JE      CMD_5                           ; jump if /U

                CMP     AL,"S"                          ;Setup
                JE      CMD_6                           ; jump if /S

                CMP     AL,"M"                          ;Escape char
                JE      CMD_7                           ; jump if /M

                CMP     AL,"C"                          ;escape Char
                JE      CMD_9                           ; jump if /C

                JMP     CMD_ERR                         ;No more legal options
CMD_5:
                OR      DH,U_SW                         ;Set bit
                JMP     CMD_2                           ;Continue scan
CMD_6:
                OR      DH,S_SW                         ;Set bit
                JMP     CMD_2                           ;Continue scan
CMD_7:
                OR      BL,BL                           ;Does a char follow?
                JZ      CMD_ERR                         ;No, syntax error

                LODSB                                   ;Get new escape char
                DEC     BL                              ;Reduce parm count
CMD_8:
                MOV     ESC_CHAR,AL                     ;Save in load copy
                JMP     CMD_2                           ;Continue scan
CMD_9:
                MOV     CX,3                            ;Number of digits to read
                MOV     BH,10                           ;Constant to multiply by
                XOR     AX,AX                           ;Set AX=0
                MOV     DI,AX                           ;    DI=0
CMD_10:
                OR      BL,BL                           ;Does a char follow?
                JZ      CMD_ERR                         ;No, syntax error

                LODSB                                   ;Get a digit in AL
                DEC     BL                              ;Adjust count

                SUB     AL,"0"                          ;Make into a number
                CMP     AL,9                            ;Make sure it's valid
                JA      CMD_ERR                         ; else error

                XCHG    DI,AX                           ;Get total in AX
                MUL     BH                              ;Multiply by 10
                ADD     DI,AX                           ;Add new digit
                LOOP    CMD_10

                MOV     AX,DI                           ;Get char in AL
                JMP     CMD_8                           ; and save it

CMD_LINE        ENDP

;-----------------------------------------------------------------------
;  The UNLOAD proc will look for a copy of ASPRN in memory that has the
;  same macro character, and unload if found. Carry clear if successful.
;  Set if error and DX points to error msg to display.
;-----------------------------------------------------------------------
UNLOAD          PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:CSEG

;-----------------------------------------------------------------------
;  Check if already loaded in memory.  Don't load multiple copies.
;  When search terminates
;       ES = BX = segment of first matching copy found in memory.
;       CS = DS = AX = segment of current copy as loaded from disk.
;  If no previous copy found
;       CS = ES = AX = BX
;  If previous copy IS found
;       (CS = DS = AX) != (ES = BX)
;-----------------------------------------------------------------------

                CALL    FIND_RES                        ;Look for resident copy
        ASSUME  ES:NOTHING                              ;May be changed by proc
```

```
                MOV     DX,OFFSET NOT_RES$      ;Default error msg
                JNC     UNLOAD_1                ;NC if successful, jump
                RET                             ;Return with carry set

;-----------------------------------------------------------------------
;  A previous copy was found in memory. Now CS=DS=new copy. ES=BX=old
;  copy.  Get the segment for the current printer interrupt.  If it's
;  the same as the seg of the resident copy, then we can deinstall.
;-----------------------------------------------------------------------
UNLOAD_1:
                PUSH    BX                      ;Save resident segment

                MOV     AX,3517H                ;Get current BIOS prn INT
                INT     21H                     ;Result in ES:BX

                POP     BX                      ;Discard offset, retrieve
                                                ; resident segment

                MOV     DX.OFFSET CANT_GO$      ;Default error message

                MOV     AX,ES                   ;Int 17 segment in AX (ES)
                CMP     AX,BX                   ; same as resident segment?

                JE      UNLOAD_2                ;Yes, remove

;-----------------------------------------------------------------------
;  Another program has intercepted the printer and we cannot deinstall.
;  Turn on the panic switch so that we'll be meerly disabled.
;-----------------------------------------------------------------------
UNLOAD_1A:
                PUSH    BX                      ;Point to resident
                POP     ES                      ; segment again
                MOV     ES:PANIC_FLAG,0FFH      ;Disable expander
                STC                             ;Indicate error
                RET                             ;Return

;-----------------------------------------------------------------------
;  No other TSRs are loaded after us.  Perform the removal.
;  1.  Restore Int 17h to its previous value.
;  2.  Release the MCB that we allocated to hold the strings.
;  3.  If code seg different than string block, release MCB for program.
;  Note that ES points to the resident segment.
;-----------------------------------------------------------------------
UNLOAD_2:
                LDS     DX,DWORD PTR ES:OLD_INT17 ;Get saved vector
        ASSUME  DS:NOTHING                      ;Changes DS
                MOV     AX,2517H                ;Restore it
                INT     21H                     ; Thru DOS

                LES     AX,DWORD PTR ES:STRING_LOC ;String segment in ES
                MOV     AH,49H                  ;Free strings block
                INT     21H                     ;Release seg in ES
                JC      UNLOAD_1A               ;Panic if error

                MOV     AX,ES                   ;Move seg to AX
                CMP     AX,BX                   ;If = program segment
                JE      UNLOAD_3                ; return

                MOV     ES,BX                   ;Free res code
                MOV     AH,49H                  ;Free strings
                INT     21H                     ; Thru DOS
                JC      UNLOAD_1A               ;Panic if error
UNLOAD_3:
                CLC                             ;Clear carry flag

                PUSH    CS                      ;Reset DS and ES
                POP     DS                      ; back to CS
                PUSH    CS
                POP     ES
                RET

UNLOAD          ENDP

;-----------------------------------------------------------------------
;  Search memory to see if a copy of this program has already been
;  loaded by looking for copyright notice.
;  If found, NC, CS = DS = AX = LOAD COPY, ES = BX = RES COPY
;  If not    CY, CS = DS = AX = ES = BX = LOAD COPY
;-----------------------------------------------------------------------
FIND_RES        PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:NOTHING


                CLD                             ;String moves forward
                NOT     WORD PTR [ENTPT]        ;Modify to avoid false match

                MOV     BX,600H                 ;BX = segment to compare
                MOV     AX,CS                   ;AX = our segment
FIND_RES_1:
                INC     BX                      ;Next paragraph
                MOV     ES,BX                   ;Set ES to search segment
                CMP     AX,BX                   ;If not load copy
                JNE     FIND_RES_2              ; test for copyright
                STC                             ;Else, flag failure
                RET
FIND_RES_2:
                MOV     SI,OFFSET ENTPT         ;String to compare
                MOV     DI,SI                   ;Offset is same
                MOV     CX,16                   ;Compare first 16 bytes
                REP     CMPSB                   ;CMP DS:SI TO ES:DI
                OR      CX,CX                   ;All matched?
                JNZ     FIND_RES_1              ;No, continue search

                CLC                             ;Set NC = success
                RET

FIND_RES        ENDP

;-----------------------------------------------------------------------
;  The program has been loaded normally, and is already resident.
;  Just replace the old strings with the new strings.
;  ES = BX = TSR segment
;-----------------------------------------------------------------------
```

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```
BADREPLACE$     DB      CR,LF,"ASPRN Failed. Suggest Reboot.",CR,LF,"$"
NEWSEGLEN       DW      0


REPLACE         PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:NOTHING

;----------------------------------------------------------------------
;  If the old string segment (as recorded in old copy) is the same as
;  the resident program segment, then they must be chopped off.
;----------------------------------------------------------------------
                MOV     AH,50H                  ;Set active PSP
                MOV     BX,ES                   ; to TSR
                INT     21H                     ;Undocumented DOS

                MOV     AX,ES:STRING_LOC[2]     ;Is old string segment
                CMP     AX,BX                   ; same as old prog seg?
                JE      REPLACE_1               ;Yes, cut them off.

;----------------------------------------------------------------------
;  The strings are in a separate block, so we can just release them.
;----------------------------------------------------------------------
                PUSH    ES                      ;Save ES

                MOV     ES,AX                   ;Segment to release
                MOV     AH,49H                  ;Free allocated memory
                INT     21H                     ; Thru DOS

                POP     ES                      ;Restore segment

                JNC     REPLACE_2               ;Continue if no erro
                JMP     REPLACE_4

;----------------------------------------------------------------------
;  Strings are still attaced to the old ASPRN.COM file.  We must surgically
;  remove them.  Shrink the old ES block down to hold just the program.
;----------------------------------------------------------------------
REPLACE_1:
                MOV     BX,(OFFSET MINIMUM - OFFSET CSEG + 15) SHR 4
                MOV     AH,4AH                  ;Setblock
                INT     21H                     ;Shrink ES
                JC      REPLACE_4

;----------------------------------------------------------------------
;  Try to locate a block large enough to contain the strings below
;  current program (in lower memory).
;----------------------------------------------------------------------
REPLACE_2:
                CALL    FIND_LOW                ;Look for memory block
                JC      REPLACE_3               ;Jump if not found

;----------------------------------------------------------------------
;  Room was found. The new segment was returned in AX.
;  Relocate the strings.  Update the pointers in the resident copy.
;----------------------------------------------------------------------
                CALL    MOVE_STRINGS            ;Copy strings to block

                MOV     AH,50H                  ;Set active PSP
                MOV     BX,CS                   ; to US
                INT     21H                     ; Thru DOS
REPLACE_2A:
                MOV     AX,4C00H                ;All done! Terminate.
                INT     21H                     ; Thru DOS

;----------------------------------------------------------------------
;  There is no room in low memory, so we want to relocate our strings
;  to the lowest possible address.  We currently own all high memory.
;  Shrink this copy's memory down to just enough to hold the program,
;  strings, and STACK.
;----------------------------------------------------------------------
REPLACE_3:
                MOV     AH,50H                  ;Set active PSP
                MOV     BX,CS                   ; back to us
                INT     21H                     ; Undocumented DOS

                PUSH    ES                      ;Save register

                MOV     AH,4AH                  ;Change size of blcok
                MOV     BX,(OFFSET LASTBYTE - OFFSET CSEG + 15) SHR 4
                MOV     NEWSEGLEN,BX            ;Save this size

                PUSH    CS                      ;Set ES to CS
                POP     ES                      ; i.e., segment to modify
                INT     21H                     ; Shrink thru DOS

                POP     ES                      ;Retrive TSR segment
                JNC     REPLACE_5
REPLACE_4:
                MOV     DX,OFFSET BADREPLACE$   ;Indicate an error
                MOV     AH,9                    ;Display string
                INT     21H                     ; Thru DOS

                MOV     ES:PANIC_FLAG,0FFH      ;Disable expander

                MOV     AX,4CFFH                ;Terminate with error
                INT     21H                     ; Thru DOS


;----------------------------------------------------------------------
;  Ask for 640K.  We'll get an error and BX will contain the largest
;  piece of memory available.  One of the better DOS functions returns.
;  New block will be above us.  Allocate all of it.
;----------------------------------------------------------------------
REPLACE_5:
                MOV     AH,48H                  ;Allocate memory
                MOV     BX,0FFFFH               ;Ask for 640K
                INT     21H                     ;Available returned in BX

                CMP     BX,(OFFSET LASTBYTE - OFFSET CSEG + 15) SHR 4
                JB      REPLACE_4

                MOV     AH,48H                  ;Allocate BX (all) paras
                INT     21H                     ;AX = new segment
                JC      REPLACE_4

;----------------------------------------------------------------------
;  Duplicate the program at the new address.  Copy from ds:si to es:di
;----------------------------------------------------------------------
                XOR     SI,SI                   ;SI = 0
                MOV     DI,SI                   ;DI = 0
                PUSH    ES                      ;Save TSR segment

                MOV     ES,AX                   ;New block
                MOV     CX,OFFSET LASTBYTE      ;Bytes to move
                CLD
                REP     MOVSB                   ;Copy to new address

                POP     ES

;----------------------------------------------------------------------
;  Now, hop up to our new home by using a far return.
;----------------------------------------------------------------------
                PUSH    AX                      ;Put new CS on stack
                MOV     DX,OFFSET TARGET        ;And address of the
                PUSH    DX                      ; next instruction
                CLI                             ;Turn off interrupts

                DB      0CBH                    ;Opcode for RETF

;----------------------------------------------------------------------
;  Now we're at AX:TARGET, in the copy of the program.  Make it real.
;----------------------------------------------------------------------
TARGET:
                PUSH    CS                      ;Move stack - lose old
                POP     SS                      ;Change segment
                MOV     SP,OFFSET STACK_TOP     ; and offset
                STI                             ;Allow interrupts

                MOV     BX,AX                   ;Get the new PSP
                MOV     AH,50H                  ;Set active PSP
                INT     21H                     ; Undocumented DOS

;----------------------------------------------------------------------
;  Release the memory held by the old copy of the program at DS.
;----------------------------------------------------------------------
                PUSH    ES                      ;Save register

                PUSH    DS                      ;Put loaded PSP seg
                POP     ES                      ; in ES

                MOV     AH,49H                  ;Free memory
                INT     21H                     ; Thru DOS

                POP     ES                      ;Restore register
                JC      REPLACE_4               ;Panic if error

                PUSH    CS                      ;Set DS to this new seg
                POP     DS

;----------------------------------------------------------------------
;  Now find the a block for the strings.
;----------------------------------------------------------------------
BREAKPT:
                MOV     AH,50H                  ;Block must belong to
                MOV     BX,ES                   ; resident copy
                INT     21H

                CALL    FIND_LOW

;----------------------------------------------------------------------
;  Copy strings from the new copy at CS:STRINGS newly allocated block.
;  Point ES to the RES copy to update the parameters.
;----------------------------------------------------------------------
                CALL    MOVE_STRINGS            ;Transfer strings

;----------------------------------------------------------------------
;  Terminate through bogus PSP.
;----------------------------------------------------------------------
                MOV     AH,50H                  ;Set active PSP
                MOV     BX,CS                   ; to right here
                INT     21H                     ;Undocumented DOS again

                PUSH    CS                      ;Point ES to the
                POP     ES                      ; current segment

                MOV     AH,4AH                  ;Setblock
                MOV     BX,NEWSEGLEN            ;Same size
                INT     21H                     ; Thru DOS
                JC      REPLACE_4               ;Panic if error

                MOV     AX,4C00H                ;Terminate thru new PSP
                INT     21H                     ; Thru DOS

REPLACE         ENDP


;----------------------------------------------------------------------
;  Look for a piece of memory large enough to hold DS:STRING_LEN bytes.
;  This is always taken from the newest program being loaded.
;  Changes:     AX,BX,CL
;----------------------------------------------------------------------
FIND_LOW        PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:NOTHING


                MOV     AH,48H                  ;Allocate memory
                MOV     BX,STRING_LEN           ;Change length in bytes
                ADD     BX,15
                MOV     CL,4
                SHR     BX,CL                   ; to paras
                INT     21H                     ; Thru DOS

                RET

FIND_LOW        ENDP

;----------------------------------------------------------------------
;  Relocate the strings from DS:STRINGS TO AX:0.  Update the pointer
;  and length in the resident copy.
;----------------------------------------------------------------------
```

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```
MOVE_STRINGS    PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:NOTHING

                PUSH    ES                      ;Save resident segment

                MOV     CX,STRING_LEN           ;Bytes to move
                MOV     ES:STRING_LEN,CX        ;Update resident copy

                XOR     DI,DI                   ;Copy to offset 0
                MOV     ES:STRING_LOC[0],DI     ;New offset

                MOV     ES:STRING_LOC[2],AX     ;New segment
                MOV     ES,AX                   ;Destination is ES:DI

                MOV     SI,OFFSET STRINGS       ;Source is DS:SI
                CLD                             ;String moves forward
                REP     MOVSB                   ; WHAM!

                POP     ES                      ;Restore segment
                RET

MOVE_STRINGS    ENDP


;-----------------------------------------------------------------------
;  This proc allows you to edit the strings.  On entry CS=DS=ES.
;  Total of program code + strings cannot exceed 64K, which is the
;  maximum size of a COM file.
;-----------------------------------------------------------------------
MEMORY$         DB      "Not Enough Memory$"
SAVE$           DB      CR,LF,"Save changes as ASPRNNEW.COM? (Y/N) $"
OVERWRITE$      DB      CR,LF,"Overwrite existing file? (Y/N) $"
FERROR$         DB      CR,LF,"File error. Try Again? (Y/N) $"
WERROR$         DB      CR,LF,"Write error. Try Again? (Y/N) $"

FILENAME        DB      "ASPRNNEW.COM",0
COM_PTR         DW      OFFSET STRING_END       ;Cannot exceed 64k-200H

ROW_END         DB      24                      ;Defaults for
COL_END         DB      80                      ; common video
COL_MAX         DB      0                       ;Rightmost column
VPAGE           DB      0                       ;Active page

ATTR            DB      0                       ;Selected attribute


;-----------------------------------------------------------------------
SETUP           PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:CSEG

                MOV     AH,4AH                  ;Modify memory block
                MOV     BX,1000H                ;Ask for 64K
                INT     21H                     ; Thru DOS
                JNC     SETUP_0                 ;Jump if no error

                MOV     DX,OFFSET MEMORY$       ;Need more room
                MOV     AH,9                    ;Display string
                INT     21H                     ; Thru DOS

                MOV     AX,4C02H                ;Terminate with error
                INT     21H                     ; Thru DOS
SETUP_0:
                CLI                             ;Disable interrupts
                MOV     SP,0FFFEH               ;Move stack to end of seg
                STI                             ;Enable interrupts

;-----------------------------------------------------------------------
;  Editing requires that we be in a text mode.
;  Clear entire screen to  desired attribute.
;-----------------------------------------------------------------------
                CALL    VIDEO_SETUP             ;Examine video hardware

                MOV     AL,COL_END              ;Right edge of screen
                SUB     AL,2                    ;(1 based) in one char
                MOV     COL_MAX,AL              ;Is rightmost column

                CALL    CLR_BOX                 ;Draw the window

;-----------------------------------------------------------------------
;  Invoke the string editor.  Returns when F7 is pressed.
;-----------------------------------------------------------------------
                CALL    EDIT                    ;String editor

                MOV     CX,COM_PTR              ;Get program length
                SUB     CX,OFFSET STRINGS       ; minus start of strings
                MOV     STRING_LEN,CX           ; is string length

;-----------------------------------------------------------------------
;  Ask if changes should be written out to ASPRNNEW.COM.  If not, just end.
;-----------------------------------------------------------------------
SETUP_1:
                MOV     DX,OFFSET SAVE$         ;Clone the changes?
                CALL    GETRESPONSE             ;Yes or No.
                JC      SETUP_2                 ;Yes, continue

                MOV     AX,4C03H                ;Terminate normally
                INT     21H                     ; Thru DOS

;-----------------------------------------------------------------------
;  Try to open the file to see if it exists.
;-----------------------------------------------------------------------
SETUP_2:
                MOV     AX,3D02H                ;Open file for r/w
                MOV     DX,OFFSET FILENAME      ; This name
                INT     21H                     ; Thru DOS
                JC      SETUP_3                 ;Jump if not found

                MOV     BX,AX                   ;Move handle

                MOV     DX,OFFSET OVERWRITE$    ;Should we overwrite?
                CALL    GETRESPONSE
                JC      SETUP_4                 ;Yes
SETUP_2A:
                MOV     AH,3EH                  ;Close file handle
                INT     21H                     ; Thru DOS
                JMP     SETUP_1                 ;Ask again
```

```
;-----------------------------------------------------------------------
;  File does not exist.  Attempt to open as new.
;-----------------------------------------------------------------------
SETUP_3:
                MOV     AH,3CH                  ;Create file fn
                XOR     CX,CX                   ; for writing
                MOV     DX,OFFSET FILENAME      ; this is name
                INT     21H                     ; Thru DOS
                JNC     SETUP_3A                ;Opened OK, jump

                MOV     DX,OFFSET FERROR$       ;Error opening file
                CALL    GETRESPONSE             ; try again?
                JC      SETUP_3                 ;Yes
                JMP     SETUP_1                 ;No
SETUP_3A:
                MOV     BX,AX                   ;Put handle in BX

;-----------------------------------------------------------------------
;  A valid file handle is in BX.  Write away.
;-----------------------------------------------------------------------
SETUP_4:
                MOV     AH,40H                  ; Write to file fn
                MOV     CX,COM_PTR              ; Length
                SUB     CX,100H                 ; Minus PSP length
                MOV     DX,100H                 ; Pointer to DTA
                INT     21H                     ; Thru DOS
                JC      SETUP_5                 ;CY signals error

                CMP     AX,CX                   ;All bytes written?
                JE      SETUP_6                 ;Yes

;-----------------------------------------------------------------------
;  An error was encountered on the write.
;-----------------------------------------------------------------------
SETUP_5:
                MOV     DX,OFFSET WERROR$
                CALL    GETRESPONSE             ;Try again?
                JC      SETUP_4                 ;Yes
                JMP     SETUP_2A                ;No

;-----------------------------------------------------------------------
;  File was written okay.  Close and exit.
;-----------------------------------------------------------------------
SETUP_6:
                MOV     AH,3EH                  ;Close file handle in BX
                INT     21H                     ; Thru DOS
                MOV     AX,4C00H                ;Terminate
                INT     21H                     ; Thru DOS

SETUP           ENDP


;-----------------------------------------------------------------------
;  Accept only a Y or N answer.  Return CY if YES, NC if NO.  DX contains
;  offset of prompt to print.
;-----------------------------------------------------------------------
GETRESPONSE     PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:CSEG

                MOV     AH,9                    ;Display string fn
                INT     21H                     ; Thru DOS
GETR_0:
                CALL    GETKEY                  ;Get a keystroke

                AND     AL,NOT 20H              ;Capitalize

                CMP     AL,"N"                  ;If NO,
                JNE     GETR_1
                                                ;If equal, CY is off
                RET                             ; just end
GETR_1:
                CMP     AL,"Y"                  ;If not YES,
                JNE     GETR_0                  ; try again
                STC                             ;Carry on
                RET

GETRESPONSE     ENDP


;-----------------------------------------------------------------------
;  Determine all the paramters and info we need to handle the display.
;  Return with carry set if incomaptible mode.
;-----------------------------------------------------------------------
COLOR_ATTR      EQU     1FH                     ;Brite white/blue

BW_ATTR         EQU     07H                     ;Reverse video

VIDEO_SETUP     PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:CSEG

                MOV     AH,0FH                  ;Get video mode
                INT     10H                     ; Thru BIOS

                MOV     ATTR,COLOR_ATTR         ;Assume color screen

                CMP     AL,3                    ;CGA video modes
                JBE     VID_3                   ; are okay

                CMP     AL,7                    ;MDA text mode
                JE      VID_2                   ; is okay, too.

                STC                             ;Else, an error
                RET                             ;Return
VID_2:
                MOV     ATTR,BW_ATTR            ;Force B/W
VID_3:
                MOV     COL_END,AH              ;Save cols
                MOV     VPAGE,BH                ;Save current page

;-----------------------------------------------------------------------
;  Determine if an EGA/VGA adapter is installed, and find row count.
;-----------------------------------------------------------------------
                MOV     AH,12H                  ;EGA alternate select
                MOV     BL,10H                  ;Return EGA info
                INT     10H                     ;Thru BIOS
                CMP     BL,10H                  ;If BL unchanged
```

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```
                MOV     DL,24                   ;Set default rows
                JE      VID_4                   ; there's no EGA/VGA

                PUSH    ES                      ;Changed by call
                MOV     AX,1130H                ;EGA info call
                MOV     BH,0                    ;Dummy argument
                INT     10H                     ; thru BIOS
                POP     ES
VID_4:
                MOV     ROW_END,DL              ;Save rows
                CLC
                RET

VIDEO_SETUP     ENDP

;=======================================================================
;  Position the cursor to the stored values.
;  Changes BX
;-----------------------------------------------------------------------
CUR_SET         PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:NOTHING

                PUSH    AX                      ;Save used register

                MOV     AH,2                    ;Position cursor fn
                MOV     BH,VPAGE                ; current page
                MOV     DX,CURSOR_POS           ; new cursor position
                INT     10H                     ; Thru BIOS

                POP     AX                      ;Restore register
                RET

CUR_SET         ENDP

;=======================================================================
;  The EDIT procedures handles all the editing. It keeps track of the
;  current macro strings and displays them on the screen as they change.
;-----------------------------------------------------------------------

; The PTR offset points to the character that appears at the left side
; of the window

PTR_ARRAY       LABEL   WORD                    ;Indicates the starting
NAM_PTR         DW      0                       ; offset of the current
STR_PTR         DW      0                       ; macro name and string

ACTIVE          DW      0                       ;Index for array

;  The screen column for positioning the cursor. Common data.

CURSOR_POS      LABEL   WORD
CURSOR_COL      DB      6                       ;Current cursor
CURSOR_ROW      DB      0                       ; position

MACRO_PTR       DB      0                       ;Pointer to string set

INS_STATE       DB      0                       ;0=INS FF=TYPEOVER

;=======================================================================
EDIT            PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:CSEG

                MOV     MACRO_PTR,0             ;Choose first string

;-----------------------------------------------------------------------
;  Display the Macro letter for these strings.
;-----------------------------------------------------------------------
EDIT_1:
                MOV     CURSOR_POS,0106H        ;Move to row 1 col 7
                CALL    CUR_SET

                MOV     AH,0AH                  ;Write character
                MOV     AL,ESC_CHAR             ; char to write
                MOV     CX,1                    ; repeat count
                INT     10H                     ; Thru BIOS

                INC     CURSOR_COL              ;Move to next column
                CALL    CUR_SET

                MOV     AH,0AH                  ;Write character
                MOV     AL,MACRO_PTR            ; number of macro
                ADD     AL,"A"                  ; convert to letter
                MOV     CX,1                    ; repeat count
                INT     10H                     ; Thru BIOS

;-----------------------------------------------------------------------
;  Initialize the pointers to point to the first macro set.
;-----------------------------------------------------------------------
                CALL    LOAD_POINTERS

;-----------------------------------------------------------------------
;  Display the selected strings on the screen as read from memory.
;-----------------------------------------------------------------------
                MOV     BX,0                    ;Index for Name

                CALL    MAKE_ACTIVE             ;Put cursor in NAME
                CALL    DISPLAY                 ;Show the string

                MOV     BX,2                    ;Index for Macro
EDIT_2:
                CALL    MAKE_ACTIVE             ;Put cursor in MACRO
                CALL    DISPLAY                 ;Show the string

;-----------------------------------------------------------------------
;  Get a key from the keyboard and act on it.
;-----------------------------------------------------------------------
KEY_0:
                CALL    GETKEY                  ;Read a key into AX

                OR      AL,AL                   ;If 0, is extended
                JZ      KEY_2                   ; which means command

                CMP     AX,BS                   ;If not actual BS key
                JNE     KEY_1                   ;Process as char

                OR      AH,AH                   ;If high byte is zero
                JZ      KEY_1                   ;Process as char
```

```
;-----------------------------------------------------------------------
;  The backspace key is the only key that requires special handling.
;  Treat BS as a CURSOR-LEFT/DELETE combination.
;-----------------------------------------------------------------------
                CALL    CURSOR_LEFT
                JC      KEY_0
KEY_0A:
                CALL    STRING_DEL              ;Delete char at cursor
                JC      KEY_0

                CALL    DISPLAY

                CMP     ACTIVE,0                ;If deleted from first
                JNE     KEY_0

                DEC     PTR_ARRAY[2]            ;Back up second
                JMP     KEY_0

;-----------------------------------------------------------------------
;  Put the character on the screen and in the string.
;-----------------------------------------------------------------------
KEY_1:
                CMP     INS_STATE,0             ;If insert
                JE      KEY_1A                  ; jump

;-----------------------------------------------------------------------
;  If at end of string, typeover works just like insert.
;-----------------------------------------------------------------------
                CALL    LOCATE_SI               ;If current char
                CMP     BYTE PTR [SI],0         ; isn't a zero byte
                JNZ     KEY_1B                  ; just overwrite
KEY_1A:
                CALL    STRING_INS              ;Create hole at cursor
                CMP     ACTIVE,0                ;If inserting first
                JNE     KEY_1B

                INC     PTR_ARRAY[2]            ;Advance second
KEY_1B:
                CALL    PUTCHAR                 ;Put AL at cursor
                CALL    DISPLAY                 ;Show changes
                                                ;Fall through
;-----------------------------------------------------------------------
;  ->  Move the cursor to the right one space.
;-----------------------------------------------------------------------
KEY_1C:
                CALL    CURSOR_RIGHT            ;Move cursor along
                JMP     KEY_0

;-----------------------------------------------------------------------
;  Key is an extended key.  Must be an instruction.
;-----------------------------------------------------------------------
KEY_2:
                CMP     AH,F7KEY                ;F7 is the exit key
                JNE     KEY_3

                MOV     CURSOR_COL,0            ;Reposition cursor
                MOV     CURSOR_ROW,NROW         ; for message
                CALL    CUR_SET

                RET                             ; and the only way out

;-----------------------------------------------------------------------
;  All remaining key disparch done from here.
;-----------------------------------------------------------------------
KEY_3:
                MOV     BL,MACRO_PTR            ;Number of set

                CMP     AH,DEL                  ;Kill char at cursor
                JE      KEY_0A

                CMP     AH,PGUP                 ;Check for PgUp
                JE      KEY_3A                  ; else check next

                CMP     AH,PGDN                 ;Move to next macro
                JE      KEY_5

                MOV     BX,ACTIVE

                CMP     AH,RARROW               ;Move right 1 char
                JE      KEY_1C

                CMP     AH,LARROW               ;Move left
                JE      KEY_9

                CMP     AH,UARROW               ;Move up
                JE      KEY_12

                CMP     AH,DARROW               ;Move down
                JE      KEY_14

                CMP     AH,INS                  ;Use Insert mode
                JE      KEY_15

                CMP     AH,ENDKEY               ;Move to end of string
                JE      KEY_16

                CMP     AH,HOME                 ;Move to start of string
                JE      KEY_17

                JMP     KEY_0                   ;Didn't recongnize it

;-----------------------------------------------------------------------
;  PgUp key:  Move to the previous macro.
;-----------------------------------------------------------------------
KEY_3A:
                DEC     BL                      ;Back up
                CMP     BL,0                    ;If below 0
                JGE     KEY_4

                MOV     BL,25                   ; reset to end
KEY_4:
                MOV     MACRO_PTR,BL            ;Update pointer
                JMP     EDIT_1                  ;Start over

;-----------------------------------------------------------------------
;  PgDn key:  Move to the next macro.
;-----------------------------------------------------------------------
```

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8088, 80286, 80386
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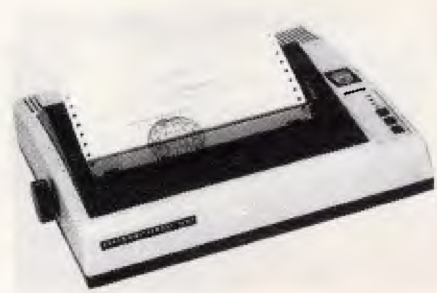

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```
KEY_5:
                INC     BL                      ;Go forward
                CMP     BL,25                   ;If past end
                JBE     KEY_4

                XOR     BL,BL                   ;Reset
                JMP     KEY_4

;-----------------------------------------------------------------------
;  <-  Move the cursor to the left one space.
;-----------------------------------------------------------------------
KEY_9:
                CALL    CURSOR_LEFT             ;Move cursor left
KEY_10:
                JMP     KEY_0                   ;Failed, ignore it

;-----------------------------------------------------------------------
;  ^   Move to the NAME field.
;-----------------------------------------------------------------------
KEY_12:
                CMP     BX,0                    ;If already active
                JE      KEY_10                  ; ignore

                MOV     BX,0                    ;Else, switch
                JMP     EDIT_2

;-----------------------------------------------------------------------
;  v   Move to the STRING field.
;-----------------------------------------------------------------------
KEY_14:
                CMP     BX,2                    ;If already active
                JE      KEY_10                  ; ignore

                MOV     BX,2                    ;else, switch
                JMP     EDIT_2

;-----------------------------------------------------------------------
;  Toggle the insert/typeovec state.
;-----------------------------------------------------------------------
KEY_15:
                NOT     INS_STATE               ;Toggle the flag
                JMP     KEY_0

;-----------------------------------------------------------------------
;  Move to end of string.
;-----------------------------------------------------------------------
KEY_16:
                CALL    CURSOR_RIGHT            ;Move to the right
                JNC     KEY_16                  ; as long as successful
                JMP     KEY_0

;-----------------------------------------------------------------------
;  Move to start of string.
;-----------------------------------------------------------------------
KEY_17:
                CALL    CURSOR_LEFT             ;Move to the left
                JNC     KEY_17                  ; as long as successful
                JMP     KEY_0

EDIT            ENDP


;-----------------------------------------------------------------------
;  Clear a window (box) for our information on the screen.
;  Add a border for a nice touch.
;-----------------------------------------------------------------------
TITLE$          DB      0B5H,"ASPRN 1.0",0C6H,0
TITLE_LEN       EQU     $-TITLE$
HELP$           DB      "STRING: ",27,32,26," INS DEL ",24,32,25
                DB      "  MACRO: PgUp PgDn  F7 = Save",0
NAME$           DB      "NAME :",0
MACRD$          DB      "MACRO:",0

BOX_CHARS       DB      0C9H,0CDH,0BBH,0BAH,020H,0BAH
                DB      199,196,182,0C8H,0CDR,0BCH

NROW            EQU     9

CLR_BOX         PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:NOTHING

                MOV     AX,0700H                ;Scroll window in
                MOV     BH,ATTR                 ; clear to this color
                XOR     CX,CX                   ;Start row,col
                MOV     DH,ROW_END              ;End row,col
                MOV     DL,COL_END
                DEC     DL
                INT     10H                     ;Thru BIOS

                MOV     BH,VPAGE                ;Get active page
                MOV     SI,OFFSET BOX_CHARS     ;Draw the edit window
                MOV     DX,CX                   ;Cursor from last call
                MOV     CX,NROW                 ;Number of rows to draw
CB_1:
                PUSH    CX                      ;Save counter
                MOV     DL,0

                MOV     AH,2                    ;Position cursor
                INT     10H                     ;Thru BIOS
                LODSB                           ;Get leftmost char
                MOV     AH,0EH                  ;Write char TTY
                INT     10H                     ;Thru BIOS

                LODSB                           ;Get middle char
                MOV     AH,0AH                  ;Write repeated char
                MOV     CL,COL_END              ;Width of box
                XOR     CH,CH
                SUB     CX,2                    ; minus 2 sides
                INT     10H                     ;Thru BIOS

                MOV     AH,2                    ;Position cursor
                MOV     DL,0
                ADD     DL,COL_END
                DEC     DL                      ;Col = righthand edge
                INT     10H                     ;Thru BIOS
```

```
                LODSB                           ;Get rightmost char
                MOV     AH,0AH                  ;Write char
                MOV     CX,1
                INT     10H                     ;Thru BIOS

                INC     DH                      ;Next row
                POP     CX                      ;Restore counter

                CMP     CL,NROW                 ;Examine row we wrote
                JE      CB_2                    ;If first row

                CMP     CL,2                    ;or next to last
                JNE     CB_1A                   ;Don't adjust count
                ADD     SI,3
CB_1A:
                TEST    CL,1                    ;If row is even
                JZ      CB_2                    ;Don't adjust count
                SUB     SI,6
CB_2:
                LOOP    CB_1

                MOV     CURSOR_ROW,0            ;Top row
                MOV     AL,COL_MAX              ;Rightmost column
                SUB     AL,TITLE_LEN+5          ;Backup
                MOV     CURSOR_COL,AL           ; to here

                MOV     SI,OFFSET TITLE$        ;Program name
                CALL    CB_3

                MOV     CURSOR_POS,0701H
                MOV     SI,OFFSET HELP$         ;Instructions
                CALL    CB_3

                MOV     CURSOR_POS,0301H
                MOV     SI,OFFSET NAME$         ;And titles
                CALL    CB_3

                MOV     CURSOR_POS,0501H
                MOV     SI,OFFSET MACRO$
CB_3:
                CALL    CUR_SET                 ;Position cursor
CB_3A:
                MOV     BH,VPAGE                ;Use active page
                LODSB                           ;Get a char
                OR      AL,AL                   ;If zero
                JZ      CB_4                    ; quit
                MOV     AH,0EH                  ;Else, write TTY
                INT     10H                     ; Thcu BIOS
                JMP     CB_3A                   ;Continue
CB_4:
                RET

CLR_BOX         ENDP

;-----------------------------------------------------------------------
;  Write the character in AL to the string as SI.
;  Changes:     SI
;  Calls:       LOCATE_SI
;-----------------------------------------------------------------------
PUTCHAR         PROC    NEAR

                CALL    LOCATE_SI               ;Point to cursor location
                MOV     [SI],AL                 ; and pop in char
                RET

PUTCHAR         ENDP


;-----------------------------------------------------------------------
;  Point SI to the same char in the string that is currently above the
;  cursor on the screen.
;  Changes:     BX,SI,CX
;-----------------------------------------------------------------------
LOCATE_SI       PROC    NEAR

                MOV     BX,ACTIVE               ;Get active index
                MOV     SI,PTR_ARRAY[BX]        ;Read string from this pt

                XOR     CH,CH                   ;Adjust the start of
                MOV     CL,CURSOR_COL           ;the string to point
                SUB     CL,7                    ;to the char at the
                ADD     SI,CX                   ;cursor

                RET

LOCATE_SI       ENDP
;-----------------------------------------------------------------------
;  Create a hole in the string by moving everything to the right.
;  Changes:     SI,DI,CX
;  Calls:       LOCATE_SI
;-----------------------------------------------------------------------
STRING_INS      PROC    NEAR

                CALL    LOCATE_SI               ;SI = current char

                MOV     CX,COM_PTR              ;End of strings offset
                MOV     DI,CX                   ;Is also target for move
                SUB     CX,SI                   ;Bytes to move

                MOV     SI,DI                   ;Copy to source register
                DEC     SI                      ;Copy from previous byte

                STD                             ;Move backwards
                REP     MOVSB                   ; whole string
                INC     COM_PTR                 ;File is longer

                RET

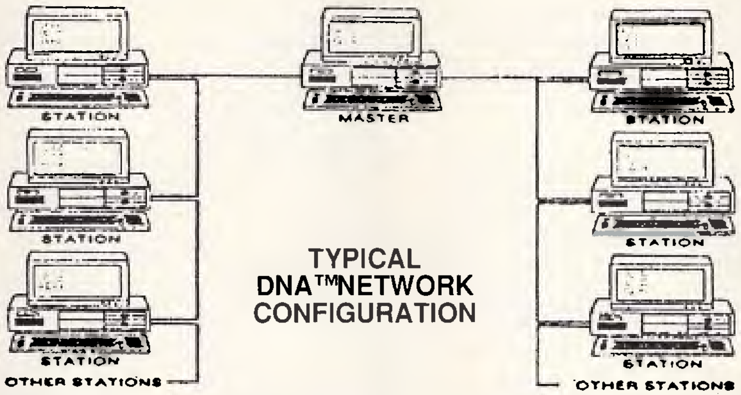
STRING_INS      ENDP

;-----------------------------------------------------------------------
;  Delete the char at the cursor.  Close up the string.
;  Changes:     CX,SI,DI
;  Calls:       LOCATE_SI
;-----------------------------------------------------------------------
```

DNA

DNA NETWORKS/PRODUCT II

A cost-efficient, full facility local area network for IBM compatible microcomputers.



TYPICAL DNA™NETWORK CONFIGURATION

As a hardware and software solution, users can share mass storage, printers and plotters and multi-user software. Several methods of file and record locking are implemented.

DNA NETWORKS /PRODUCT II allows a maximum number of 64 workstations on a single cluster. The DNA Networks/Product II Network consists of a half size board which is installed into a PC. The communication link is twisted pair cable with a maximum distance of 5,000 foot. The Network software is loaded as a device driver within DOS which provides easy installation and transparency to the end-user.

INSTALLATION takes approximately twenty minutes for a two user network. The hardware requires placement in an available slot within the computers, running the twisted-pair cable between the computers and connecting the cable to the boards. Software installation consists of running a two minute installation at each and re-boot personal computers.

THE MASTER (File Server) of the Network can be any IBM compatible microcomputer. The master is not dedicated to performing the file serving function. It can be used as a workstation. The Network will support any mass storage and printing devices which can be used on a stand-alone computer.

FILE AND RECORD LOCKING

DNA Networks/product II supports:

DNA File & Record Locking

DOS 3.x File & Record Locking

Novell's File and Record Locking emulation plus NETBIOS.

As a result, of the implementation of these facilities, most multi-user application software is supported.

A WORKSTATION can be any IBM compatible microcomputer. The PC itself can have any form of local mass storage device or local printing device. The workstation can also be a floppyless unit, booting up across the network.

THE UNIQUE attribute of the DNA Networks/Product II is that once installed, the end-user does not need to learn additional commands. As an example, network commands can be embedded within batch files which automatically spool for the user, send printed documents to the print queue + print the document. All these features can be implemented within menu programs thereby making the entire process transparent to the end-user.

RELIABILITY is one of DNA Networks/Product II's most important qualities. DNA Networks Inc. has worked very hard to establish DNA Networks/Product II as the most transparent local area network on the market today. As a result, DNA Product II is easy to install and uncomplicated to use. We continue to research industry improvements to maintain a constant awareness of hardware and software advances.

SUPPORT is a commitment which we extend to the buyers of DNA Product II products through the technical support group. The services may include telephone technical support, dealer training (when available).

SPECIFICATIONS

Hardware Compatibility:	IBM-AT,XT,PC, PS/2 AND COMPATIBLES (call to determine if compatible is on the approval list).
Software Compatibility:	PC/MS DOS 2.0 to the most current release.
Performance:	Transfer rate up to 25 megabits per second.
Architecture:	Hierarchical with workstations polling (Daisy-chain connection).
Cable	Shielded twisted-pair, maximum length 5,000 feet.
User Stations:	1 to 64 workstations (including floppyless capability).
Network Master:	Any computer with a mass storage device and printer ports; master can be used as a workstation.
Print Serving:	Up to 5 simultaneous printers, file spooling, with a print queue facility.
File and Record Locking	DOS 3.x, DNA Networks/Product II File and Record Locking, NETBIOS, and optional Novell File Record Locking Emulation.
Features:	Log-on with Password Security, Message Switching, Enhanced DOS Features, and Network Diagnostics.
System Impact:	80 KB on the Master and 6 KB on each workstation.

(Specifications are subject to change).

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```
STRING_DEL      PROC    NEAR

                CALL    LOCATE_SI                       ;Point to current char
                CMP     BYTE PTR [SI],0                 ;Can't backup too far
                JNZ     SO_1
                STC                                     ;Error
                RET
SD_1:
                MOV     CX,COM_PTR                      ;End of strings offset
                SUB     CX,SI                           ;Bytes to move
                OEC     CX                              ;Is one less

                MOV     DI,SI
                INC     SI                              ;Copy from previous byte

                CLD                                     ;Move backwards
                REP     MDVSB
                DEC     COM_PTR                         ;File gets shorter
                CLC
                RET

STRING_BEL      ENDP

;----------------------------------------------------------------------
;  Move the cursor left/right 1 char.  Return NC if success, CY if fail.
;  Changes:     SI,CX
;  Calls:       LOCATE_SI, CUR_SET, DISPLAY
;----------------------------------------------------------------------
CURSOR_RIGHT    PROC    NEAR

                CALL    LOCATE_SI
                CMP     BYTE PTR [SI],0                 ;Are we on last char
                JNE     CR_0                            ;of string? jmp if yes
CR_A:
                STC                                     ;Signal failure
                RET
CR_0:
                MDV     CL,CURSOR_COL
                CMP     CL,COL_MAX                      ;Is cursor at screen edge
                JE      CR_2                            ;yes, jump

                INC     CL                              ;Move to next col
CR_1:
                MOV     CURSOR_COL,CL                   ;Save (getkey updates)
                CALL    CUR_SET
                CLC                                     ;Signal success
                RET
CR_2:
                INC     PTR_ARRAY[DX]                   ;Move the start

                PUSH    CURSOR_POS                      ;Save current cursor

                MDV     CURSOR_COL,7                    ;Redisplay from left side
                CALL    CUR_SET                         ;Set cursor
                CALL    DISPLAY                         ;Draw string

                POP     CURSOR_POS                      ;Reset old cursor
                CALL    CUR_SET
                CLC
                RET

;----------------------------------------------------------------------
CURSOR_LEFT     PROC    NEAR

                MOV     CL,CURSOR_COL                   ;Is cursor
                CMP     CL,7                            ; at 1st column?
                JE      CL_1                            ;Yes, jump

                DEC     CL                              ;Back up cursor
                JMP     CR_1
CL_1:
                MOV     SI,PTR_ARRAY[BX]                ;Start of window

                DEC     SI                              ;Back one char
                CMP     BYTE PTR [SI],0                 ;Past start of string?
                JE      CR_A                            ;Yes, jump

                MDV     PTR_ARRAY[BX],SI
                CALL    DISPLAY
                CLC
                RET

CURSOR_LEFT     ENDP

CURSOR_RIGHT    ENDP

;----------------------------------------------------------------------
;  On entry BX contains 0 = Name or 2 = String.  This proc makes the
;  selected string "active."  The cursor position is determined from
;  the pointer positions and are retained when jumping up and down.
;  Changes:     DH
;----------------------------------------------------------------------
MAKE_ACTIVE     PROC    NEAR

                MOV     ACTIVE,BX                       ;Change active index

                MOV     CURSOR_COL,7                    ;Leftmost column

                MOV     DH,3                            ;Row for name
                OR      BX,BX                           ; if bx=0
                JE      MA_1
                MOV     DH,5                            ;Else row for string
MA_1:
                MOV     CURSOR_ROW,DH                   ;save coords
                RET

MAKE_ACTIVE     ENDP

;----------------------------------------------------------------------
;  Load the pointers for a new macro set.
;  Changes:     BL
;  Calls:       GET_POINTER
;----------------------------------------------------------------------
LOAD_POINTERS   PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:CSEG

                MOV     BL,MACRO_PTR                    ;String to look for

                SHL     BL,1                            ; they come in pairs

                CALL    GET_POINTER                     ;Load pointer
                MOV     NAM_PTR,SI                      ;Save offset

                INC     BL                              ;Next string
                CALL    GET_POINTER                     ;Load pointer
                MOV     STR_PTR,SI                      ;Save offset

                RET

LOAD_POINTERS   ENDP

;----------------------------------------------------------------------
;  Find the BLth string in the list.  0-based.  Returns SI pointing
;  to the start of the string.
;  Changes:     AX,BH,SI
;----------------------------------------------------------------------
GET_POINTER     PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:CSEG

                MOV     SI,OFFSET STRINGS               ;Start scan here
                XOR     BH,BN                           ;String counter
GP_0:
                CMP     BH,BL                           ;Pointing to right string?
                JNE     GP_1                            ;No, keep scanning

                RET
GP_1:
                LODSB                                   ;Read char
                OR      AL,AL                           ;Is it 0?
                JNZ     GP 1
                INC     BH
                JMP     GP_0

GET_POINTER     ENDP

;----------------------------------------------------------------------
;  This procedure will write the active string to the screen from the
;  current cursor position forward.  It is called only when a char is
;  typed or the window is pushed.
;  Changes:     AX,BX,CX,SI
;  Calls:       CUR_SET, LOCATE_SI
;----------------------------------------------------------------------
DISPLAY         PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:CSEG

                CLD                                     ;String moves forward
                CALL    CUR_SET                         ;Position the cursor
                CALL    LOCATE_SI                       ;Point SI to string

                MOV     CH,CURSOR_COL
                MOV     CL,COL_MAX                      ;Rightmost column
DISPLAY_0:
                LODSB                                   ;Get character
                OR      AL,AL                           ;Is it end of string?
                JNZ     DISPLAY_1                       ;No, jump
                DEC     SI                              ;Yes, back up
                MOV     AL,20H                          ;Print a space
DISPLAY_1:
                CALL    CUR_SET                         ;Position the cursor

                PUSH    CX                              ;Save register

                MOV     AH,0AH                          ;Write Char
                MOV     BH,VPAGE                        ;Active page
                MOV     CX,1
                INT     10H                             ;Thru BIOS

                POP     CX                              ;Restore register

                INC     CURSOR_COL                      ;Change position

                CMP     CL,CURSOR_COL                   ;Is col <= end?
                JAE     DISPLAY_0                       ;Yes, continue

;  Past the end of the window - done with display.

                MOV     CURSOR_COL,CH                   ;Return to old spot
                CALL    CUR_SET                         ; do it

                RET

DISPLAY         ENDP

;----------------------------------------------------------------------
;  Get a character from the keyboard.  Generate Idle interrupt for
;  compatibility with other TSRs.
;  Changes:     AX
;----------------------------------------------------------------------

GETKEY          PROC    NEAR
        ASSUME  CS:CSEG, DS:CSEG, ES:CSEG

GETKEY_1:
                INT     28H                             ;Generate Dos Idle

                MOV     AH,1                            ;Request KBD status
                INT     16H                             ; Thru BIOS
                JZ      GETKEY_1                        ;None ready

                XOR     AH,AH                           ;Fetch the key
                INT     16H                             ; Thru BIOS

                RET

GETKEY          ENDP

;----------------------------------------------------------------------
;  The strings are stored here in ASCIIZ form.
;----------------------------------------------------------------------
```

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WITH 80 M/BYTE HARD DISK:

& single 360K Floppy Disk Drive	**$3,895**
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- 80286 CPU
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- 8 Slots
- Floppy & Hard Disk Controller
- Printer Card and RS232
- Keyboard
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- Manual
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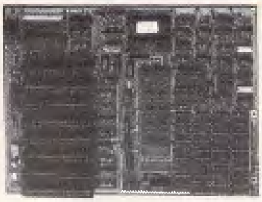

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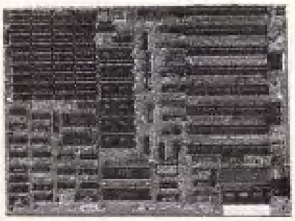
(WITHOUT MEMORY)

- 4.77MHz
- 8088 Processor
- Expandable to 640K on board.
- Provisions for up to 6 x 2732 EPROMs on board.
- Keyboard connector
- 8 Expansion slots

Cat.X18020 (Excl. Ram) **$119**

Cat.X18026 (Incl. Ram) **$414**

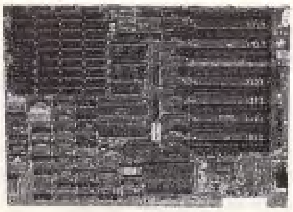


XT* TURBO MOTHERBOARD

- 8MHz
- 8088 Processor
- Expandable to 640K on board.
- Provisions for up to 6 x 2732 EPROMs on board
- Keyboard connector
- 8 Expansion slots

X18030 (excl. RAM) **$169**

X18031 (incl. 640K RAM) **$499**



10 MHz XT* TURBO MOTHERBOARD

Increase the performance of your sluggish XT* approximately four times with this super fast motherboard.

- 8088-2 running at 10 MHz, no wait state
- Turbo/Normal selectable
- 640K fitted
- 8 Expansion slots
- 4 Channel DMA
- Keyboard port

Excluding RAM .. **$249**

Including RAM) .. **$579**

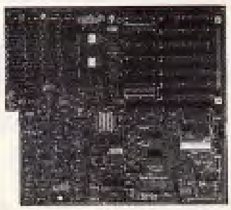
BABY AT* MOTHERBOARD

(WITHOUT MEMORY)

- 6/10 MHz system clock with sero wait state.
- 80286-10 Microprocessor
- Hardware and software switchable
- Socket for 80287 numeric data co-processor
- 256K, 512K, 640K, or 1,024K RAM
- 64K ROM
- Phoenix BIOS
- 8 Expansion slots

X18200 (excl. RAM) **$689**

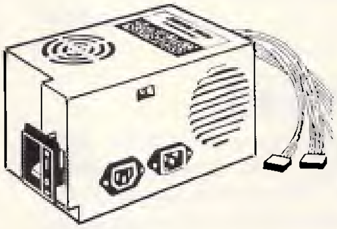
X18201 (incl.640K RAM) **$1,019**



6/10 MHz AT* MAIN BOARD

- 6/10 MHz system clock with zero wait state
- Hardware and software switches for alternative system clock.
- Rechargeable battery backup for CMOS configuration table and real time clock.
- 80286-10 microprocessor
- Socket for 80287 numeric data co-processor
- 256KB, 512KB, 640KB, or 1,024KB RAM
- 64KB ROM, expandable to 128KB
- 8 Input/Output slots
- Hardware reset jumper
- Power and turbo LED connector
- Phoenix BIOS

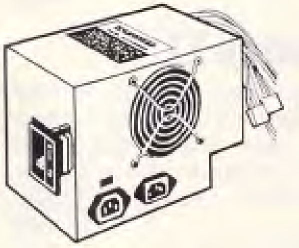
X18100 (Excl. RAM) **$689**



150W SWITCH MODE POWER SUPPLY FOR IBM* PC*/XT* & COMPATIBLE

DC OUTPUT: +5/13A, -5V/0.5A
+12V/4.5A -12V/0.5A

Cat. X11096 .... **$145**



200W SWITCH MODE POWER SUPPLY FOR IBM* AT* & COMPATIBLE

DC OUTPUT: +5/16A, -5V/0.5A
+12V/5A -12V/0.5A

Cat. X11097 .... **$199**

180W SWITCH MODE POWER SUPPLY FOR BABY AT* COMPATIBLES

Cat. X11098 .... **$189**

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Our latest computer casing, featuring security key switch, 8 slots, and mounting accessories etc.
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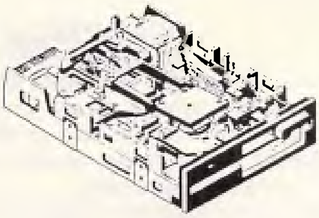
- Status displays, Power, Cap Lock and Numeric Lock

Just like the "real McCoy" only at a fraction of the price! Why pay more?

Cat. X12020 .... **$109**



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Top quality at an incredibly low price! Double sided, double density. Switchable 1·2 M/Byte to 720K formatted capacity. IBM* AT* compatible.

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NEC 3½" DISK DRIVE

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C11905 .. **ONLY $255**

MITSUBISHI 4851 DISK DRIVE

Slimline, 360K, Double sided, double density

C11901 .. **ONLY $229**

20 M/BYTE HARD DISK

Tandon, including DTC controller card, 12 month warranty. IBM* compatible.

X20010 .. **ONLY $595**

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IBM* compatible.

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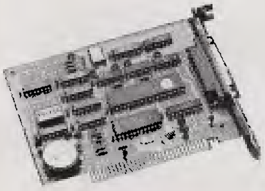
DTC HARD DISK CONTROLLER CARDS

X18060 (XT) **$190**
X18140 (AT) **$290**



RS232 & CLOCK CARD

(WITHOUT CABLE)

This RS232 card supports 2 asynchronous communication ports. Programmable baud rate generator allows operation from 50 baud to 9600 baud. Fully buffered. Clock includes battery back-up and software.

Cat. X18028 .... **$89**

RS232 (SERIAL) CARD

(WITHOUT CABLE)

This RS232 card supports 2 asynchronous communication ports. Programmable baud rate generator allows operation from 50 baud to 9600 baud. Fully buffered. Second serial port is optional.

Cat. X18026 .... **$49**

CLOCK CARD

Complete clock card including battery back-up and software.

Cat. X18024 .... **$55**

GAMES I/O CARD

Features two joystick ports. (DB15).

Cat. X18019 .... **$37**

I/O PLUS CARD

Provides a serial port, a parallel port and a joystick port, and even a clock/calendar with battery backup!

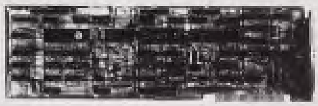
Cat. X18045 .... **$119**

768K MULTIFUNCTION I/O CARD

(Includes cable but not 41256 RAM)

- Serial port
- Parallel port
- Games port
- Clock/Calendar with battery back-up
- provision for second serial port

Cat. X18050 .... **$194**



MULTI I/O & DISK CONTROLLER CARD

This card will control 2 x double sided, double density drives, and features a serial port, a parallel port, and a joystick port or games port. It also has a clock/calendar generator with battery backup.

Cat. X18040 .... **$145**

MULTI SERIAL CARD

- 4 RS232C asynchronous communication serial ports. One fitted 3 optional.
- NS16450 Asynchronous communication elements (ACE)
- COM1/COM/2 COMPATIBLE
- DTE/DCE Selectable
- Drive support for PC*/AT*, XENIX*
- Interactive installation procedure available.

X18154 .... **$139**

16 BIT FLOPPY DISK DRIVE CONTROLLER CARD

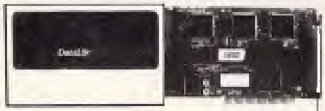
These cards will control up to 2 or 4 double sided 360K IBM* compatible disk drives.

X18005 (2 Drives) . **$52**
X18006 (4 Drives) . **$55**

1·2 M/BYTE/360K FLOPPY CONTROLLER CARD

The ideal solution for backing up hard disk, archiving etc. Suitable for 1·2 M/Byte and 360K drives. XT* and AT* compatible

Cat. X18008 .... **$124**



VERBATIM HARD DISK CARD

Available 20 or 30 M/Byte! IBM* compatible, plugs straight in to your computers bus connectors!

X20020 .... **$955**
X20030 .... **$1,095**

640K RAM CARD (SHORT SLOT)

- 640K memory installed
- User selectable from 64K to 640K
- DIP switches to start address

X18014 .. **ONLY $229**

2 M/BYTE RAM CARD

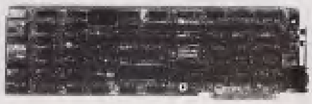
Plugs straight into BUS ports on mother-board. XT* compatible. RAM not included.

X18052 (Excl.RAM) **$194**

386 MAIN BOARD

- Intel 80386 CPU (16MHz)
- Socket for 80387 Math co-processor
- 32 bit BUS system, 1 M/Byte or 640K on board memory
- Built-in speaker attachment
- Battery backup for CMOS configuration table and real time clock.
- Keyboard controller and attachment
- 7 Channel DMA
- 16 Level interrupts
- 3 Programmable timers
- 8 System expansion I/O slots:
  5 with a 36 pin and a 62 pin expansion slot 2 with only the 62 pin expansion slots 1 with two 62 pin expansion slots (32 bit BUS)

X18101 .... **$2,489**

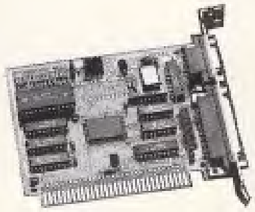


COLOUR GRAPHICS CARD

This card plugs staight into I/O slot and gives RGB or composite video in monochrome to a monitor.

Colour graphics: 320 dots x 200 lines.
Mono graphics: 640 dots x 200 lines.

Cat. X18002 .... **$107**



GRAPHICS CARD

- Hercules compatible
- Interface to TTL monochrome monitor
- One Centronics parallel printer port
- 2K-Static RAM, 64K Dynamic RAM
- Display Mode: 720 dots x 348 lines

Cat. X18003 .... **$139**

PRINTER CARD

This card features a parallel interface for Centronics printers such as the Epson RX-80, 100, and other similar printers. Included is printer data port, printer control port, and printer status port.

Cat. X18017 .... **$35**

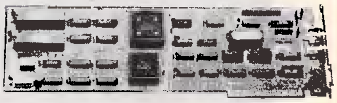
COLOUR GRAPHICS & PRINTER CARD

This combination card features printer and monitor interface. It has 1 parallel printer port, RGB CTTC outputs.

Colour:
Text Mode: 40 columns x 25 rows.
Graphics: 320 x 200

Monochrome:
Text Mode: 80 columns x 25 rows.
Graphics: 640 x 200

Cat. X18010 .... **$124**



ENHANCED GRAPHICS ADAPTOR CARD

- 256K display RAM
- Handles monochrome, CGA Hercules and E.G.A.
- Paradise* compatible
- Up to 16 colours
- Standards: 320 x 200, 640 x 200, 640 x 348, and 720 x 348.

X18070 .... **$239**

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```
                DB      0
STRINGS         DB      26 DUP(0,0),0           ;They start empty
STRING_END      EQU     $

PC              =       $

PC              =       PC + 256

STACK_TOP       =       PC

LASTBYTE        =       PC

CSEG    ENDS
        END     ENTPT
```

ends

```
100 REM -- BASIC PROGRAM TO CREATE asprn.COM
110 OPEN "asprn.COM" AS #1 LEN = 1
120 FIELD #1,1 AS A$
130 CHECKSUM = 0
140 FOR I = 1 TO  290
150    LINESUM = 0
155    PRINT ".";
160    FOR J = 1 TO 8
170       READ BYTE
180       CHECKSUM = CHECKSUM + BYTE
190       LINESUM = LINESUM + BYTE
200       IF (BYTE < 256) THEN LSET A$ = CHR$(BYTE)
210       PUT #1
220    NEXT J
230    READ LINECHECK
240    IF LINECHECK <> LINESUM THEN PRINT 'Error in Line";280 + 10 * I
250 NEXT I
260 CLOSE
270 IF CHECKSUM = 226727 THEN PRINT "Successful completion!" : END
280 PRINT "COM file is not valid!" : END
290 DATA    233,    61,     1,   126,    65,    83,    80,    82,   731
300 DATA     78,    32,    49,    46,    48,    32,    40,    33,   371
310 DATA     41,    32,    49,    57,    56,    56,    32,    90,   413
320 DATA    105,   102,   102,    32,    67,   111,   109,   109,   737
330 DATA    117,   110,   105,    99,    97,   116,   105,   111,   860
340 DATA    110,   115,    32,    67,   111,    46,    13,    10,   504
350 DATA     80,    67,    32,    77,    97,   103,    97,   122,   675
360 DATA    105,   110,   101,    32,   254,    32,    82,   111,   827
370 DATA     98,   101,   114,   116,    32,    76,    46,    32,   615
380 DATA     72,   117,   109,   109,   121,   108,    13,    10,   659
390 DATA     36,    26,     0,     0,     0,     0,   214,     9,   285
400 DATA      0,     0,    53,     0,     0,     0,    46,   128,   227
410 DATA     62,    93,     1,     0,   117,     5,   251,    10,   539
420 DATA    228,   116,     6,   250,    46,   255,    46,    82,  1029
430 DATA      1,    46,   128,    62,    92,     1,     0,   117,   447
440 DATA     16,    46,    68,     6,     3,     1,   117,   235,   492
450 DATA     46,   254,     6,    92,     1,   180,     2,   235,   816
460 DATA    226,    46,   198,     6,    92,     1,     0,    46,   615
470 DATA     58,     6,     3,     1,   116,   213,    12,    32,   441
480 DATA     44,    97,    60,    25,   119,   231,   232,     2,   810
490 DATA      0,   235,   226,    30,    86,    81,    46,   197,   901
500 DATA     54,    86,     1,   138,   200,     2,   201,   254,   936
510 DATA    193,    10,   201,   116,     9,   254,   201,   172,  1156
520 DATA     10,   192,   117,   251,   235,   243,   172,    10,  1230
530 DATA    192,   116,    13,   156,    50,   228,    46,   255,  1056
540 DATA     30,    82,     1,   128,   252,    16,   116,   238,   863
550 DATA     89,    94,    11,   195,   252,   190,   214,    29,  1074
560 DATA    191,   249,     1,   139,    14,    90,     1,   140,   825
570 DATA      6,    88,     1,   137,    62,    86,     1,   139,   520
580 DATA    209,     3,   215,   243,   164,   131,   194,    15,  1174
590 DATA    177,     4,   211,   234,   184,     0,    49,   205,  1064
600 DATA     33,    78,   111,   116,    32,    82,   101,   115,   668
610 DATA    105,   100,   101,   110,   116,    36,    67,    97,   732
620 DATA    110,   110,   111,   116,    22,    65,   110,   105,   779
630 DATA    110,   115,   116,    97,   108,   108,    36,    85,   775
640 DATA    115,    97,   103,   101,    58,    32,    32,    65,   603
650 DATA     83,    80,    82,    78,    32,    91,    32,    47,   525
660 DATA     85,    32,   124,    32,    47,    83,    32,    93,   528
670 DATA     91,    32,    47,    77,   120,    32,   124,    32,   555
680 DATA     47,    67,   110,   110,   110,    32,    93,    36,   605

690 DATA    250,   188,    11,    11,   251,   186,     4,     1,   902
700 DATA    180,     9,   205,    33,     6,   139,    30,    44,   646
710 DATA      0,   142,   195,   180,    73,   205,    33,     7,   835
720 DATA    232,    91,     0,   115,    12,   186,    23,     2,   661
730 DATA    180,     9,   205,    33,   184,     1,    76,   205,   893
740 DATA     33,   246,   196,     1,   116,    10,   232,   192,  1026
750 DATA      0,   114,   237,   184,     0,    76,   205,    33,   849
760 DATA    246,   196,     2,   116,     3,   233,   230,     2,  1028
770 DATA    232,   250,     0,   114,     3,   233,    68,     1,   895
780 DATA      6,   184,    23,    53,   205,    33,   137,    30,   671
790 DATA     82,     1,   140,     6,    84,     1,     7,   184,   505
800 DATA     23,    37,   186,    94,     1,   205,    33,   232,   811
810 DATA    229,     1,   115,     3,   233,    45,   255,   232,  1113
820 DATA    237,     1,   186,    30,     0,   184,     0,    49,   687
830 DATA    205,    33,    32,    44,    59,     9,    50,   246,   678
840 DATA    150,   128,     0,   172,    10,   192,   117,    44,   813
850 DATA    248,   138,   230,   195,   136,   216,    12,   219,  1394
860 DATA    116,   246,   172,   254,   203,   191,   178,     2,  1362
870 DATA    185,     4,     0,   242,   174,   116,   239,    60,  1020
880 DATA     47,   116,     4,   180,   255,   249,   195,    10,  1056
890 DATA    219,   116,   248,   172,   254,   203,    36,   223,  1471
900 DATA     60,    85,   116,    14,    60,    83,   116,    15,   547
910 DATA     60,    77,   116,    16,    60,    67,   116,    24,   536
920 DATA    235,   225,   128,   206,     1,   235,   199,   128,  1357
930 DATA    206,     2,   235,   194,    10,   219,   116,   211,  1193
940 DATA    172,   254,   203,   162,     3,     1,   235,   182,  1212
950 DATA    185,     3,     0,   183,    10,    51,   192,   139,   763
960 DATA    248,    10,   219,   116,   190,   172,   254,   203,  1412
970 DATA     44,    48,    68,     9,   119,   181,   151,   246,   866
980 DATA    231,     3,   248,   226,   236,   139,   199,   235,  1517
990 DATA    218,   232,    73,     0,   186,   249,     1,   115,  1074
1000 DATA     1,   195,    83,   184,    23,    53,   205,    33,   777
1010 DATA    91,   186,     6,     2,   140,   192,    59,   195,   871
1020 DATA   116,    10,    83,     7,    38,   198,     6,    93,   551
1030 DATA     1,   255,   249,   195,    38,   197,    22,    82,  1039
1040 DATA     1,   184,    23,    37,   205,    33,    38,   196,   717
1050 DATA     6,    86,     1,   180,    73,   205,    33,   111,   698
1060 DATA   225,   140,   192,    59,   195,   116,     8,   142,  1077
1070 DATA   195,   180,    73,   205,    33,   114,   211,   248,  1259
1080 DATA    14,    31,    14,     7,   195,   252,   247,    22,   782
1090 DATA     0,     1,   187,     0,     6,   140,   200,    67,   601
1100 DATA   142,   195,    59,   195,   117,     2,   249,   195,  1154
1110 DATA   190,     0,     1,   139,   254,   185,    16,     0,   785
1120 DATA   243,   166,    11,   201,   117,   233,   248,   195,  1414
1130 DATA    13,    10,    65,    83,    80,    82,    78,    32,   443
1140 DATA    70,    97,   105,   108,   101,   100,    46,    32,   659
1150 DATA    83,   117,   103,   103,   101,   115,   116,    32,   770
1160 DATA    82,   101,    98,   111,   111,   116,    46,    13,   678
1170 DATA    10,    36,     0,     0,   180,    80,   140,   195,   641
1180 DATA   205,    33,    38,   161,    88,     1,    59,   195,   780
1190 DATA   116,    11,     6,   142,   192,   188,    73,   205,   927
1200 DATA    33,     7,   115,    12,   235,    52,   144,   187,   785
1210 DATA    30,     0,   180,    74,   205,    33,   114,    42,   678
1220 DATA   232,   156,     0,   114,    14,   232,   167,     0,   915
1230 DATA   180,    80,   140,   203,   205,    33,   184,     0,  1025
1240 DATA    76,   205,    33,   180,    80,   140,   203,   205,  1122
1250 DATA    33,     6,   180,    74,   187,   177,     0,   137,   794
1260 DATA    30,   194,     3,    14,     7,   205,    33,     7,   493
1270 DATA   115,    18,   186,   160,     3,   180,     9,   205,   876
1280 DATA    33,    38,   198,     6,    93,     1,   255,   184,   808
1290 DATA   255,    76,   205,    33,   180,    72,   187,   255,  1263
1300 DATA   255,   205,    33,   129,   251,   177,     0,   114,  1164
1310 DATA   225,   180,    72,   205,    33,   114,   219,    51,  1099
1320 DATA   246,   139,   254,     6,   142,   192,   185,    11,  1175
1330 DATA    11,   252,   243,   164,     7,    80,   186,    76,  1019
1340 DATA     4,    82,   250,   203,    14,    23,   188,    11,   775
1350 DATA    11,   251,   139,   216,   100,    80,   205,    33,  1115
1360 DATA     6,    30,     7,   180,    73,   205,    33,     7,   541
1370 DATA   114,   176,    14,    31,   190,    80,   140,   195,   938
1380 DATA   205,    33,   232,    26,     0,   232,    39,     0,   767
1390 DATA   180,    80,   140,   203,   205,    33,    14,     7,   862
1400 DATA   180,    74,   139,    30,   194,     3,   205,    33,   858
1410 DATA   114,   144,   184,     0,    76,   205,    33,   180,   936
1420 DATA    72,   139,    30,    90,     1,   131,   195,    15,   673
1430 DATA   177,     4,   211,   235,   205,    33,   195,     6,  1066
1440 DATA   139,    14,    90,     1,    38,   137,    14,    90,   523
1450 DATA     1,    51,   255,    38,   137,    62,    86,     1,   631
1460 DATA    38,   163,    88,     1,   142,   192,   190,   214,  1028
1470 DATA     9,   252,   243,   164,     7,   195,    78,   111,  1059
1480 DATA   116,    32,    69,   118,   111,   117,   103,   104,   762
1490 DATA    32,    77,   101,   109,   111,   114,   121,    36,   701
1500 DATA    13,    10,    83,    97,   118,   101,    32,    99,   553
1510 DATA   104,    97,   110,   103,   101,   115,    32,    97,   759
1520 DATA   115,    32,    65,    83,    80,    82,    78,    78,   613
1530 DATA    69,    87,    46,    67,    79,    77,    63,    32,   520
1540 DATA    40,    89,    47,    78,    41,    32,    36,    13,   376
1550 DATA    10,    79,   118,   101,   114,   119,   114,   105,   760
1560 DATA   116,   101,    32,   101,   120,   105,   115,   116,   806
1570 DATA   105,   110,   103,    32,   102,   105,   108,   101,   766
1580 DATA    63,    32,    40,    89,    47,    78,    41,    32,   422
1590 DATA    36,    13,    10,    70,   105,   108,   101,    32,   475
1600 DATA   101,   114,   114,   111,   114,    46,    32,    84,   716
1610 DATA   114,   121,    32,    65,   103,    97,   105,   110,   747
1620 DATA    63,    32,    40,    89,    47,    78,    41,    32,   422
1630 DATA    36,    13,    10,    87,   114,   105,   116,   101,   582
1640 DATA    32,   101,   114,   114,   111,   114,    46,    32,   664
1650 DATA    84,   114,   121,    32,    65,   103,    97,   105,   721
1660 DATA   110,    63,    32,    40,    89,    47,    78,    41,   500
1670 DATA    32,    36,    65,    83,    80,    82,    78,    78,   534
1680 DATA    69,    87,    46,    67,    79,    77,     0,    11,   436
1690 DATA    10,    24,    80,     0,     0,     0,   100,    74,   368
1700 DATA   187,     0,    16,   205,    33,   115,    12,   186,   754
1710 DATA   182,     4,   180,     9,   205,    33,   184,     2,   799
1720 DATA    76,   205,    33,   250,   188,   254,   255,   251,  1512
1730 DATA   232,   148,     0,   160,    98,     5,    44,     2,   689
1740 DATA   162,    99,     5,   232,   105,     2,   232,   219,  1056
1750 DATA     0,   139,    14,    95,     5,   129,   233,   214,   829
1760 DATA     9,   137,    14,    90,     1,   186,   200,     4,   641
1770 DATA   232,    96,     0,   114,     5,   164,     3,    76,   710
1780 DATA   205,    33,   184,     2,    61,   186,    82,     5,   758
1790 DATA   205,    33,   114,    16,   139,   216,   186,   239,  1140
1800 DATA     4,   232,    71,     0,   114,    29,   180,    62,   692
1810 DATA   205,    33,   235,   217,   180,    60,    51,   201,  1182
1820 DATA   186,    82,     5,   205,    33,   115,    10,   186,   822
1830 DATA    17,     5,   232,    46,     0,   114,   237,   235,   896
1840 DATA   196,   139,   216,   180,    64,   139,    14,    95,  1043
1850 DATA     5,   129,   233,     8,     1,   186,     0,     1,   555
1860 DATA   205,    33,   114,     4,    59,   193,   116,    10,   734
1870 DATA   186,    49,     5,   232,    13,     0,   114,   227,   826
1880 DATA   235,   196,   180,    62,   205,    33,   184,     0,  1095
1890 DATA    76,   205,    33,   180,     9,   205,    33,   232,   973
1900 DATA   190,     3,    36,   223,    60,    78,   117,     1,   708
1910 DATA   195,    60,    89,   117,   242,   249,   195,   180,  1327
1920 DATA    15,   205,    16,   198,     6,   101,     5,    31,   577
1930 DATA    60,     3,   118,    11,    60,     7,   116,     2,   377
1940 DATA   249,   195,   198,     6,   101,     5,     7,   136,   897
1950 DATA    38,    98,     5,   136,    62,   100,     5,   180,   624
1960 DATA    18,   179,    16,   205,    16,   128,   251,    16,   829
1970 DATA   178,    24,   116,     9,     6,   184,    48,    17,   582
1980 DATA   183,     0,   205,    16,     7,   136,    22,    97,   666
1990 DATA     5,   248,   195,    80,   180,     2,   138,    62,   910
2000 DATA   100,     5,   139,    22,   104,     6,   205,    16,   597
2010 DATA    88,   195,     0,     0,     0,     0,     0,     0,   283
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2020 DATA     6,     0,     0,     0,   198,     6,   106,     6,   322
2030 DATA     0,   199,     6,   104,     6,     6,     1,   232,   554
2040 DATA   217,   255,   180,    10,   160,     3,     1,   185,  1011
2050 DATA     1,     0,   205,    16,   254,     6,   104,     6,   592
2060 DATA   232,   200,   255,   180,    10,   160,   106,     6,  1149
2070 DATA     4,    65,   185,     1,     0,   205,    16,   232,   708
2080 DATA   203,     2,   187,     0,     0,   232,   175,     2,   801
2090 DATA   232,   236,     2,   187,     2,     0,   232,   166,  1057
2100 DATA     2,   232,   227,     2,   232,    25,     3,    10,   733
2110 DATA   192,   116,    75,    61,     0,    34,   117,    38,   633
2120 DATA    10,   228,   116,    26,   232,   112,     2,   114,   840
2130 DATA   235,   232,    19,     2,   174,   240,   232,   198,  1262
2140 DATA     2,   131,    62,   182,     6,     0,   117,   220,   640
2150 DATA   255,    14,   108,     6,   235,   214,   120,    62,  1014
2160 DATA   107,     6,     0,   116,     8,   232,   205,     1,   675
2170 DATA   120,    68,     0,   117,    14,   232,   217,     1,   769
2180 DATA   131,    62,   182,     6,     0,   177,     4,   255,   677
2190 DATA     6,   100,     6,   232,   177,     1,   232,   158,   984
2200 DATA     2,   232,   248,     1,   235,   174,   120,   252,  1272
2210 DATA    65,   117,    14,   178,     6,   124,     6,     0,   510
2220 DATA   190,     6,   105,     6,     9,   212,    87,   255,   878
2230 DATA   175,   118,    70,   106,     6,   120,   252,    83,   919
2240 DATA   116,   167,   178,   252,    73,   116,    47,   128,  1027
2250 DATA   252,    81,   116,    50,   139,    30,   182,     6,   784
2260 DATA   128,   252,    77,   116,   204,   128,   252,    75,  1212
2270 DATA   116,    55,   178,   252,    72,   116,    56,   129,   923
2280 DATA   252,    88,   116,    62,   128,   252,    82,   116,  1088
2290 DATA    68,   128,   252,    39,   116,    70,   128,   252,  1093
2300 DATA    71,   116,    73,   233,    94,   255,   254,   203,  1299
2310 DATA   128,   251,     0,   125,     2,   179,    25,   136,   846
2320 DATA    10,   106,     6,   233,    19,   255,   254,   195,  1098
2330 DATA   128,   251,    25,   118,   242,    50,   219,   235,  1268
2340 DATA   238,   232,   195,     1,   231,    61,   255,   131,  1316
2350 DATA   251,     8,   116,   248,   187,     0,     0,   233,  1035
2360 DATA    44,   255,   131,   251,     2,   116,   237,   187,  1223
2370 DATA     2,     0,   237,    33,   255,   246,    22,   187,   898
2380 DATA     6,   233,    32,   255,   232,   181,     1,   115,   975
2390 DATA   251,   233,    24,   255,   232,   152,     1,   115,  1263
2400 DATA   251,   233,    16,   255,   181,    65,    83,    80,  1164
2410 DATA    82,    70,    32,    49,    46,    48,   198,     8,   533
2420 DATA    83,    84,    82,    73,    78,    71,    58,    32,   561
2430 DATA    27,    32,    76,    32,    73,    78,    83,    32,   383
2440 DATA    68,    69,    76,    32,    24,    32,    25,    32,   358
2450 DATA    32,    77,    65,    67,    82,    79,    58,    32,   492
2460 DATA    80,   103,    95,   112,    32,    80,   183,    68,   667
2470 DATA   110,    32,    32,    70,    55,    32,    61,    32,   424
2480 DATA    83,    97,   118,   101,     0,    28,    65,    77,   619
2490 DATA    69,    32,    58,     0,    77,    65,    67,    82,   450
2500 DATA    79,    58,     0,   201,   205,   187,   186,    32,   918
2510 DATA   106,   199,   195,   182,   200,   205,   188,   104,  1510
2520 DATA     0,     2,   138,    62,   181,     5,    51,   201,   565
2530 DATA   138,    54,    97,     5,   138,    22,    90,     5,   557
2540 DATA   254,   202,   205,    16,   138,    62,   100,     5,   982
2550 DATA   190,   235,     7,   139,   209,   185,     9,     0,   974
2560 DATA    81,   179,     8,   180,     2,   205,    16,   172,   834
2570 DATA   180,    14,   205,    26,   172,   180,    10,   138,   915
2580 DATA    14,    98,     5,    50,   237,   131,   233,     2,   770
2590 DATA   205,    16,   188,     2,   170,     0,     2,    22,   605
2600 DATA    98,     5,   254,   202,   205,    16,   172,   180,  1132
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2610 DATA    10,   185,     1,     0,   205,    16,   254,   198,   869
2620 DATA    89,   120,   249,     9,   116,    16,   128,   249,   984
2630 DATA     2,   117,     3,   131,   198,     3,   246,   193,   893
2640 DATA     1,   116,     3,   131,   238,     6,   226,   184,   905
2650 DATA   198,     6,   105,     6,     0,   160,    99,     5,   579
2660 DATA    44,    17,   162,   104,     6,   190,   156,     7,   686
2670 DATA   212,    33,     0,   199,     6,   104,     6,     1,   561
2680 DATA     7,   198,   160,     7,   232,    21,     0,   199,   824
2690 DATA     6,   104,     6,     1,     3,   190,   221,     7,   579
2700 DATA   212,     9,     0,   199,     6,   104,     6,     1,   537
2710 DATA     5,   190,   233,     2,   232,   188,   253,   138,  1241
2720 DATA    52,   180,     5,   172,    18,   192,   116,     6,   663
2730 DATA   180,    14,   205,    16,   235,   241,   195,   232,  1318
2740 DATA     3,     0,   134,     4,   195,   139,    10,   102,   609
2750 DATA     6,   139,   183,    98,     6,    50,   237,   178,   857
2760 DATA    14,   184,     6,   128,   233,     7,     3,   241,   736
2770 DATA   195,   232,   233,   255,   139,    14,    95,     5,  1169
2780 DATA   139,   249,    43,   206,   139,   247,    78,   253,  1354
2790 DATA   243,   164,   255,     6,    95,     5,   195,   232,  1195
2800 DATA   211,   255,   128,    68,     0,   117,     2,   243,  1022
2810 DATA   195,   139,    14,    95,     5,    43,   206,    77,   770
2820 DATA   139    254,    70,   252,   243,   164,   255,    14,  1371
2830 DATA    95,     5,   249,   195,   232,   182,   255,   128,  1340
2840 DATA    60,     0,   117,     2,   249,   195,   138,    14,   775
2850 DATA   104,     6,    58,    14,    99,     5,   116,    11,   413
2860 DATA   251,   193,   136,    14,   104,     6,   232,    66,  1005
2870 DATA   253,   249,   195,   255,   135,    98,     6,   255,  1445
2880 DATA    54,   104,     6,   198,     6,   104,     6,     2,   485
2890 DATA   232,    48,   253,   232,   185,     0,   143,     6,  1019
2900 DATA   184,     6,   232,    59,   253,   248,   195,   138,  1214
2910 DATA    14,   184,     6,   128,   249,     7,   116,     4,   620
2920 DATA   254,   201,   235,   206,   139,   183,    98,     6   1322
2930 DATA    28,   128,    68,     0,   116,   182,   132,   183,   884
2940 DATA    98,     6,   212,    66,     0,   248,   195,   177,   982
2950 DATA    30,   182,     6,   198,     6,   184,     6,     7,   459
2960 DATA   182,     3,    11,   219,   116,     2,   182,     5,   720
2970 DATA   136,    54,   105,     6,   195,   138,    38,   106,   778
2980 DATA     6,   208,   227,   232,    14,     0,   137,    54,   878
2990 DATA    98,     6,   254,   195,   232,     5,     0,   137,   927
3000 DATA    54,   180,     6,   135,   198,   214,     9,    58,   818
3010 DATA   255,    58,   251,   117,     1,   195,   172,    10,  1059
3020 DATA   192,   117,   251,   254,   199,   235,   242,   252,  1742
3030 DATA   232,   192,   252,   232,    23,   255,   130,    46,  1370
3040 DATA   104,     6,   130,    14,    99,     5,   172,    10,   540
3050 DATA   192,   117,     3,    20,   176,    32,   232,   178,  1800
3060 DATA   252,    81,   109,    10,   138,    62,   180,     5,   828
3070 DATA   185,     1,     0,   205,    16,    89,   254,     6,   756
3080 DATA   104,     6,    58,    14,   104,     6,   115,   222,   629
3090 DATA   136,    46,   104,     6,   232,   140,   252,   195,  1111
3100 DATA   205,    40,   180,     1,   205,    22,   116,   240,  1012
3110 DATA    50,   228,   205,    22,   195,     0,     0,     0,   700
3120 DATA     0,     0,     0,     0,     0,     0,     0,     0,     0
3130 DATA     0,     0,     0,     0,     0,     0,     0,     0,     0
3140 DATA     0,     0,     0,     0,     0,     0,     0,     0,     0
3150 DATA     0,     0,     0,     0,     0,     0,     0,     0,     0
3160 DATA     0,     0,     0,     0,     0,     0,     0,     0,     0
3170 DATA     0,     0,     0,     0,     0,     0,     0,     0,     0
3180 DATA     0,     0,     0,     0,     0,     0,     0,     0,     0
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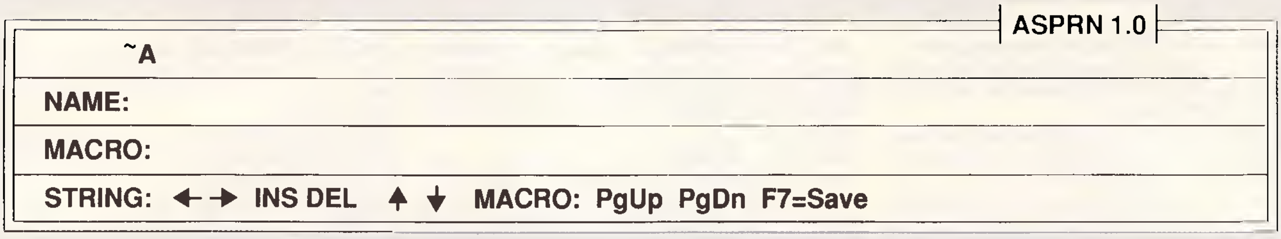
ASPRN Edit Window



```
                                                    | ASPRN 1.0 |
          ~A
NAME:
MACRO:
STRING: ←→ INS DEL  ↑ ↓  MACRO: PgUp PgDn F7=Save
```

When ASPRN is started with the /S switch, macros can be entered and changed using the built-in editor interface shown here.

The third line contains the macro or control string itself. This may consist of any combination of characters (excluding the NULL), and it can be of nearly any length. No control string, no matter how arcane or complex, is beyond your reach.

A sample macro

Most laser printers don't provide a convenient way to eject a page. If you've just dashed off a small note and want to move to the top of a new page, you usually have to take the printer off-line and press a button or two. Since I keep my printer across the room, this means getting up from the desk and breaking my train of thought (a dangerous venture at my age). Worse yet, the high cost of laser printers forces some people to share a printer that may be in another room. And even if you have a batch file that echoes the form-feed character to the printer, you have to be at the DOS prompt to use it. To help you get the feel of the program and improve your productivity immediately, let's start by creating a macro that sends a form-feed code to the printer.

First, start ASPRN in setup mode, as described above. The window will appear and the fields should be blank except for the macro name, where you should see ~A. The cursor will be positioned on the line marked MACRO:. Now type the phase, 'Send a form feed to the printer'. The Name field doesn't affect the macro expansion, so you can be as elaborate as you wish.

If you make a mistake when typing, don't panic — full editing support is provided for the strings. As you would expect, the Backspace key removes the character preceding the current cursor position, and the Del key removes the character right above the cursor. If you delete characters in the middle of a string, the editor will close up the string automati-

EASY-DOS-IT MASTER MENU PROGRAM

```
AUGUST 31, 1987        #000000 EASY-DOS-IT                 11:14:16
                         HARD DISK UTILITIES

 COMMANDS                       DESCRIPTION

    1          SEARCH FOR A FILE ON THE HARD DISK
    2          ADD A NEW DIRECTORY
    3          REMOVE A DIRECTORY

    4          LIST ALL CURRENT DIRECTORIES
    5          LIST THE FILES WITHIN A DIRECTORY
    6          COPY FILE(S) FROM A FLOPPY TO HARD DISK

    7          COPY FILE(S) FROM HARD DISK TO A FLOPPY
    8          COPY FILE(S) BETWEEN HARD DISK DIRECTORIES
    9

 Beginning menu   Command   Dos menu   Maintenance   Next menu   eXit easy
```

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cally. Insert and typeover modes are toggled by pressing the Ins key.

To switch between the Macro field and the Name field, use the Up and Down Arrow keys. To position the cursor, use the Left and Right Arrow keys to navigate through the string. Rapid movement to the extremes of the edit field is provided by the Home and End keys, which will take you to the beginning or end of the string, respectively. Although we're working with only a single macro in this example, you can move between macros at any time by using the PgUp and PgDn keys.

> *'To help make our lives as trouble-free as possible, ASPRN absorbs the control strings you enter and makes them part of its .COM file.'*

The ASPRN editing window is video environment aware and will automatically adjust to fit any video mode that has a screen width of more than ten characters. (If you have a colour video system, try bringing up the editor when you're in 40-column mode.) But since there is no practical limit on the length of a string (strings can be nearly 64k long), the problem of displaying strings that exceed the available display space on the screen still exists. To solve this problem, ASPRN uses a single line of displayed text that scrolls left or right as needed. The cursor remains always in the visible portion of the string. Users of Lotus 1-2-3 will fell right at home using the ASPRN editor. I liked the look and feel of text scrolling off the left and right edges of the screen, and I patterned my editor after it.

Entering control sequences

After you've entered the descriptive name for a macro, use the Down Arrow to move back to the Macro: field. Note that there's no need to press the Enter key at the end of the line. Entering the control string is as easy as typing the macro name. Since the ASCII code for a form-feed is Ctrl-L, simply hold down the Ctrl key and type the letter L. A single, strange-looking character will appear in the display. This is the representation used in the IBM character set to display character 12, the form-feed. If the macro string you need uses the ESC character (ASCII 27, or 1Bh), as most will, just hit the Esc key.

While other sequences will undoubtedly be more complex, this one is complete. To end the session, press the F7 key. Any time you terminate an edit session, the following prompt will appear:

```
'Save changes as
ASPRNNEW.COM (Y/N)  ?'
```

Type the letter Y to save the changes you have made.

To help make our lives as trouble-free as possible, ASPRN absorbs the control strings you enter and makes them part of its .COM file. Thus, when the editing session is concluded and you decide to save your changes, ASPRN modifies itself to include the new strings, updates all the parameters used for loading, and writes out a cloned version of itself under the name ASPRNNEW.COM.

The name you give to the ASPRN program on your disk makes no difference to the program itself — it still knows that it's really called ASPRN — so several versions can exist at once. For example, you could have ASPRNJOE.COM and ASPRNJAN.COM, and each person could customise the control strings to take advantage of his printer, word processor, or typing habits.

If you wish, you can replace the old copy of the program with the new one. If both files are in the current directory, simply execute the following commands at the DOS prompt.

```
COPY ASPRNNEW.COM  ASPRN.COM
DEL ASPRNNEW.COM
```

Loading and running ASPRN

Once the file has been edited, saved, and optionally renamed, it can be loaded. Because ASPRN is a memory-resident program — and one that deals with the printer — a few precautions should be taken. ASPRN should be loaded after any print spoolers and after any redirection using the MODE command has taken place. Although ASPRN is memory resident, it's not a pop-up and doesn't use the keyboard interrupt at all.

All that's required to load the file is to execute it. Do this by typing

```
ASPRN
```

at the command line. Using some complicated relocation techniques, ASPRN will worm its way into memory, shrink down to a minimum size, and stay resident. From that point on, any output will be filtered through ASPRN and expanded as required.

In our example above, we defined ~A as the form-feed character. To try it out, type the following instructions at the DOS prompt. (Be sure that you have a printer connected, turned on, and ready to print, and that the top-of-form is properly set.)

```
COPY CON PRN
THIS IS LINE 1
THIS IS LINE 2
~A
^Z
```

To generate the ^Z, either press the F6 key, or hold the Ctrl key and tap the letter Z. DOS will then copy the two lines of text to your printer, and will then try to send ~A the same way. But ASPRN will intercept it and substitute the form-feed. Your effort should be rewarded by the page ejecting from a sheet feeder or advancing to the top of a new form.

The macro character

The tilde character doesn't appear very often in my copy of 100 Common Business Letters. But some applications may use it (1-2-3 uses it to represent a carriage return). Should you find a need to print a tilde, you have several options available. The first is to use a double tilde (~~). When ASPRN sees two macro characters in a row, it deletes the first one but lets the second pass through. This is a good way to deal with an occasional use of the character out of the macro context.

> *'If you make a mistake when typing, don't panic — ASPRN provides full editing support for the strings.'*

Changing at load time

When you have a version of ASPRN that you would like to load, but you want to change the macro character for that session, you can use either the /M or the /C command-line switches.

They both perform the same function: they change the macro character when the program is loaded into memory.

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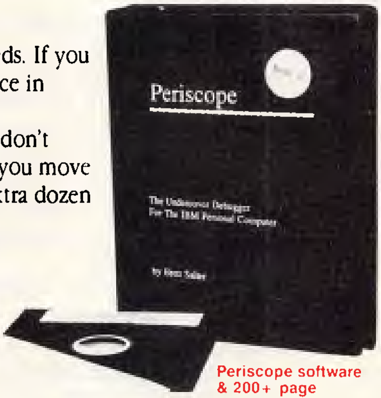

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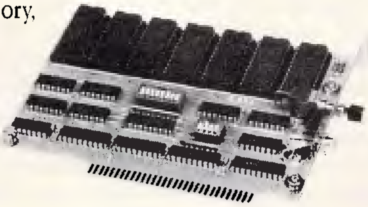

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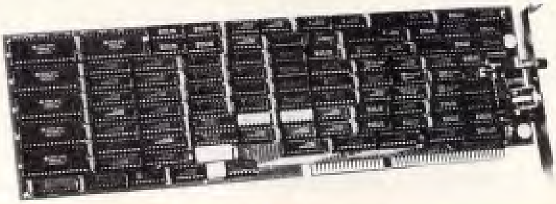

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Two switches that perform the same function are required because of the input limitations of DOS. While many characters you might want to use to initiate the macro sequence can be typed in at the command line, some simply cannot be. For example, changing the macro character from the tilde to the pound sign can be accomplished by entering

```
ASPRN /M#
```

Now all macros that previously began with the tilde will respond to the respective pound-letter combinations the same way. Note that if you specify the macro character in this way, on the command line, you must continue to do so each time you execute ASPRN during that session. This is because ASPRN is dynamically modified at load time. So to uninstall this version you must enter

> *'You might find it handy to keep a version of ASPRN around that simply translates the macro strings into their original form.'*

```
ASPRN /M# /U
```

While the /M switch works for common, printable characters like the pound sign, you can't use it to enter some characters that the IBM PC uses for control. For example, try to enter the Backspace character (ASCII 8) or the Esc character (ASCII 27). Pressing the Backspace or Esc key is interpreted as a command for DOS and not as a character. For such cases, you can specify the macro characters as follows:

```
ASPRN /C027
```

Your entry must be exactly three decimal digits, so include any leading zeros, and it must not be separated from the /C switch by any spaces. In the inset line above, ESC, which corresponds to decimal 27, would be loaded into the program as the macro character.

A more permanent change

If you change the macro character at load time, you must specify it every time you run the program. A more permanent and convenient way to modify it is to invoke both the macro and the setup switches, thus:

```
ASPRN /S /M#
```

When the /S switch is specified, the program is not loaded into memory, but simply set up for editing. When the edit window appears, it will contain the name of the first macro, as usual, and it will also contain the specified character — in this case, #A. When *this* file is saved, using the F7 key, the change in macro character will be made permanent by writing it out as the default in ASPRNNEW.COM.

Different versions of ASPRN with different macro characters act like totally independent programs. Thus, if you have created two versions, one using the tilde and one using the pound, both can be loaded simultaneously, yielding 52 macros: ~A-~Z and #A-#Z. The order of installation is only important if the macro string in one expansion contains a macro that needs to be expanded by the second copy of ASPRN. In that case, load the dependent version first.

Temporarily disabling ASPRN

You might find it handy to keep a version of ASPRN around that simply translates the macro strings into their original form. In other words, the string entry for the macro ~A would actually be ~A, and so on. Then, if a macro is accidentally invoked, the original characters will be sent to the printer and no one will be the wiser.

There may also come a time when you want to remove ASPRN from memory. As mentioned before, built into the program is the ability to uninstall itself in an orderly fashion. You simply invoke ASPRN with the uninstall switch as follows:

```
ASPRN /U
```

Of course, to remove the program from memory, it must have been previously installed. And if you have loaded ASPRN with the /M or /C switch, you must specify the same switch on the command line when you remove it. Finally, if you have loaded copies of ASPRN with distinct macro characters, they must be removed in the opposite order they were installed — last in, first out. If for some reason the uninstall cannot be performed safely, ASPRN will print a message to that effect, and you

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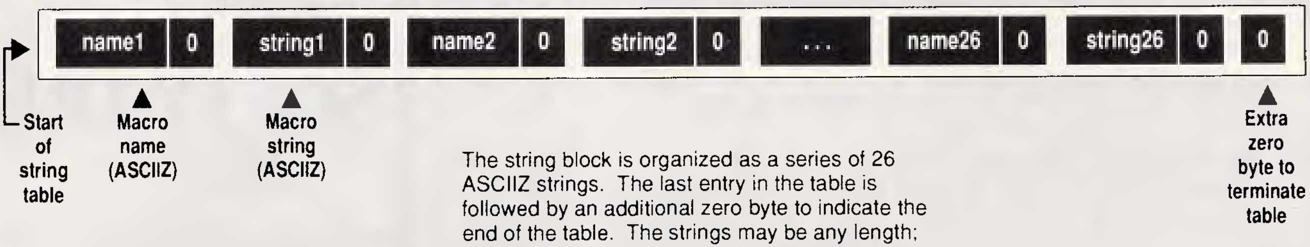
String Block Structure



The string block is organized as a series of 26 ASCIIZ strings. The last entry in the table is followed by an additional zero byte to indicate the end of the table. The strings may be any length; each one can be located in memory by counting the terminating zeros that precede it.

must remove any TSRs loaded after it and try again. Failing that, you must then reboot to remove it.

Replacing macro strings

ASPRN has the ability to allow the macro definitions to be replaced at any time. This might be useful, for example, when you have one set of printer macros for 1-2-3, another for dBASE, and a third you use to give WordStar some life. You could keep three different copies of ASPRN in three directories and simply invoke the relevant one for your immediate needs. The key is to make sure that in each case you use the same macro character. ASPRN can then replace just the strings and keep memory use to a minimum.

The inside story

The assembly source code for ASPRN is heavily commented in order to make it accessible even to beginning assembly programmers. To explain the reasoning behind the code, I'll divide the narrative into three parts that correspond to the major parts of the program: the macro expander, the text editor, and the memory manager.

(Note that up until now, I have referred to the character used to designate a macro (eg, the tilde in ~A) as the macro character. In reality, it is more appropriate to refer to it as the escape character. I have avoided using this term to minimise confusion with the normal Esc character, 1Bh (or 27d). In the broad sense of the term, an escape character has some property not associated with other characters. In our case, it triggers a macro expansion. In the assembly code, the terms escape character and escape sequence will be used).

Macro expansion mechanics

Ironically, the portion of the program that expands the strings is also the smallest and easiest to understand. When first loaded and made resident, ASPRN splices into the chain for Int 17h, the printer interrupt. This is done by first saving the segment and offset of the old interrupt handler and then substituting ASPRN's own address. From that moment on, any attempt to print a character using the BIOS will be filtered through ASPRN first.

Once resident, the program sits quietly in the printer path and compares each character that passes by to the macro character. Assuming the tilde is the macro character, the logic is simple: if the character intercepted is the tilde, you set a flag and throw the character away. If the next character is not in the range of A to Z, you assume it's an error, so you reset the flag and discard the second character as well. If the second character is valid, control is transferred to the EXPAND procedure. The block of strings is then scanned to find the correct macro string, which is sent to the printer.

The format of the string block in memory is illustrated in the diagram 'String Block Structure'. Note that each macro requires two strings to describe it: the name string and the expansion string. One method of handling strings is to use a table of fixed-length entries. With this method, an arbitrary maximum size — 255 bytes, for example — is allo-

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cated for each string. Then, no matter how small the string, 255 bytes of storage are always used. And because the length is fixed, the string can never be larger than the artificially imposed limit of 255 characters.

But if we use variable-length strings in the ASCIIZ format (a string followed by a byte equal to zero), the length of a string becomes irrelevant. A string is assumed to end when the zero byte is reached. By reading the entire string block (and counting zeros to keep track of position), any string can be found. The fixed-length technique is fast, requiring only a few instructions to figure the offset of any string, but it exacts a heavy toll in flexibility.

The macro expansion is quite simple. Once the correct string has been located, the macro string bytes are sent to the printer, one at a time, through the original interrupt 17h handler. If an error occurs, the expansion is terminated and control is returned to the program that originally requested the printing.

Editor string handling

The operation of the string editor is reasonably straightforward and has much in common with most editors. It has two major functions: string handling and video display. The string handling functions embodied here can serve as a model for readers who want to design their own editors or build editing capability into their programs.

The editor's operation is based on the design specification that the string block will always be set up as a contiguous sequence of bytes in memory. The starting address of the first byte in the block is assumed to be known, and all other bytes are located by their relative offset.

To insert a byte at a certain location — for example, at the cursor position — all bytes starting at the cursor must be pushed ahead in order to make room, increasing the length of the string block. To delete a byte, the bytes following the cursor are simply backed up one position, decreasing the size of the block. Overwriting just changes the contents of the box and doesn't cause any movement. The diagram 'Mechanics of String Operations' illustrates these three operations.

STRING_INS and STRING_DEL perform all string movement. Taking advantage of the 8088's built-in string handling instructions, the procedure is painless and reasonably fast. On computers with slower clock speeds, attempting to move a string whose length is near 64k will cause a noticeable delay. Although this would be unacceptable in a commercial word processor, the simplicity of the operation is worth the trade-off in a small utility.

The string operations are all designed to take place at the current cursor position, so some means of moving forward and backward through the string is required. The two procedures CURSOR_RIGHT and CURSOR_LEFT satisfy this need. The procedures are nested in the assembly listing to take advantage of common code.

Making these routines modular greatly reduces the code size. The Backspace operation can be divided into two sub-operations: move the cursor left, then delete the character at the cursor. The Home key simply calls CURSOR_LEFT until it runs out of string. Other complex operations are built from smaller, modular actions.

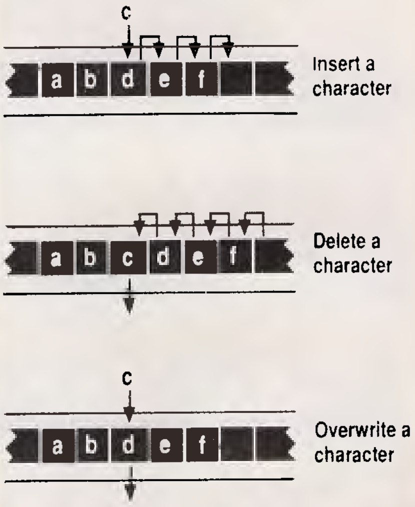
The string block is at the end of the .COM file, after executable code. A one-word variable, COM_PTR, keeps track of the length of the file in bytes, including strings. Any editor operation that changes the length of the strings causes a corresponding change in the COM_PTR. If, after editing, ASPRNNEW.COM is written to disk, COM_PTR will be used to determine its length.

Although editing the strings is easy on the assembly code level, it would be a tough job for the user if the strings weren't visible. Displaying the strings requires using pointers, relative addressing, and the concept of the virtual window.

When ASPRN loads, it checks the video hardware to find out the current screen state. The most important thing it looks for is the number of columns available on the screen. To work, the screen must be at least ten characters wide. This is certainly the normal situation for most text modes. When the screen width has been established, the edit window is drawn.

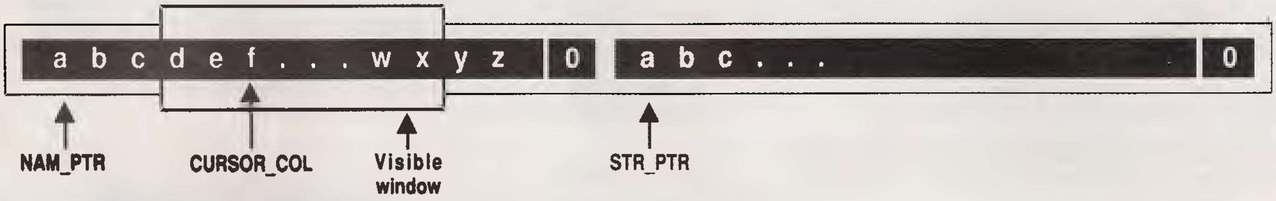
Several pointers are maintained to keep track of what is on the screen and where. (See the diagram 'Edit Display Organisation'.) First, NAM_PTR and STR_PTR hold in memory the offset of the character in the current macro name and macro string, respectively, displayed in the left-most column of the visible window. Initially, that is the same as the first character in each string. The screen cursor row and column are stored in the bytes labelled CURSOR_ROW and

Mechanics of String Operations



Working with strings at the character level involves three basic functions: insert, delete, and replace. The mechanics of these operations are illustrated above.

Edit Display Organization



With the ASPRN editor, only a small portion of the total string in memory may be visible at any one time. That portion is said to appear in the visible window. The screen cursor can be positioned anywhere within the visible window.

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CURSOR_COL, but are collectively referred to by the label CURSOR_POS when convenient. When the editing session begins, the cursor is in the leftmost column of the Name field, and the string pointers are set to the beginning of the strings.

The procedure DISPLAY has the responsibility of placing the right characters at the correct location on-screen. It does this based on one assumption: changes in the string can only occur from the current cursor position forward. A flag, ACTIVE, is kept to indicate which string — the macro name or the macro string — is being edited. When a change is made that requires a screen refresh (inserting or deleting a character or horizontal scrolling), DISPLAY is called.

To find the location in memory of the character at the screen cursor, the offset of the cursor in the window is added to the address of the character at the left side. This operation is performed by the procedure LOCATE_SI. To refresh the screen, characters are then copied from memory to the screen either until there are no more characters left or until the right edge of the window is reached.

Memory management

A good portion of ASPRN's code is dedicated to minimising the amount of RAM occupied when the program is resident. I felt this was important for two reasons. First, I've seen too many commercial TSR programs that perform otherwise useful functions require unforgivably large amounts of memory when resident. They simply become unusable.

Second, ASPRN is a dynamic program. The block of macro strings may be replaced at any time by loading a modified version of the program. Without good memory management techniques, ASPRN would litter old string blocks throughout RAM. That's both wasteful and technically inelegant.

DOS's memory allocation is based on the technique of a linked list of blocks of memory. Each block has a header that describes the block's length and the process that owns it. By tracing the chain of blocks, DOS can perform a rudimentary check on the reliability of memory.

A memory block is divided by creating a new header between two existing headers and linking it into the list by changing the size parameter of the lower header. Similarly, two contiguous blocks may be combined by eliminating the intervening header from the list.

Although it's possible to manipulate the headers directly, it's not really necessary. For all but the most arcane applications,

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the three services DOS provides to control memory are quite sufficient. Under the umbrella of Int 21h, these functions are: 48h — allocate a memory block; 49h — de-allocate a memory block; and 4Ah — resize an existing memory block.

The diagram 'Flowchart of Memory Management Logic' illustrates the logic of the memory handling. (Although some very good programmers say some bad things about flowcharts from time to time, ASPRN would never have been possible without them). It has a single purpose: load the macro strings as a contiguous block at the lowest possible memory address.

Terminate and stay small

The diagram 'ASPRN's Major Functional Program Modules' shows a memory image of the ASPRN program just after it is loaded. Each program loaded by DOS is also given a copy of the current environment in a separate memory block. Since it has no use for this information, ASPRN immediately releases the block so that it may be reallocated.

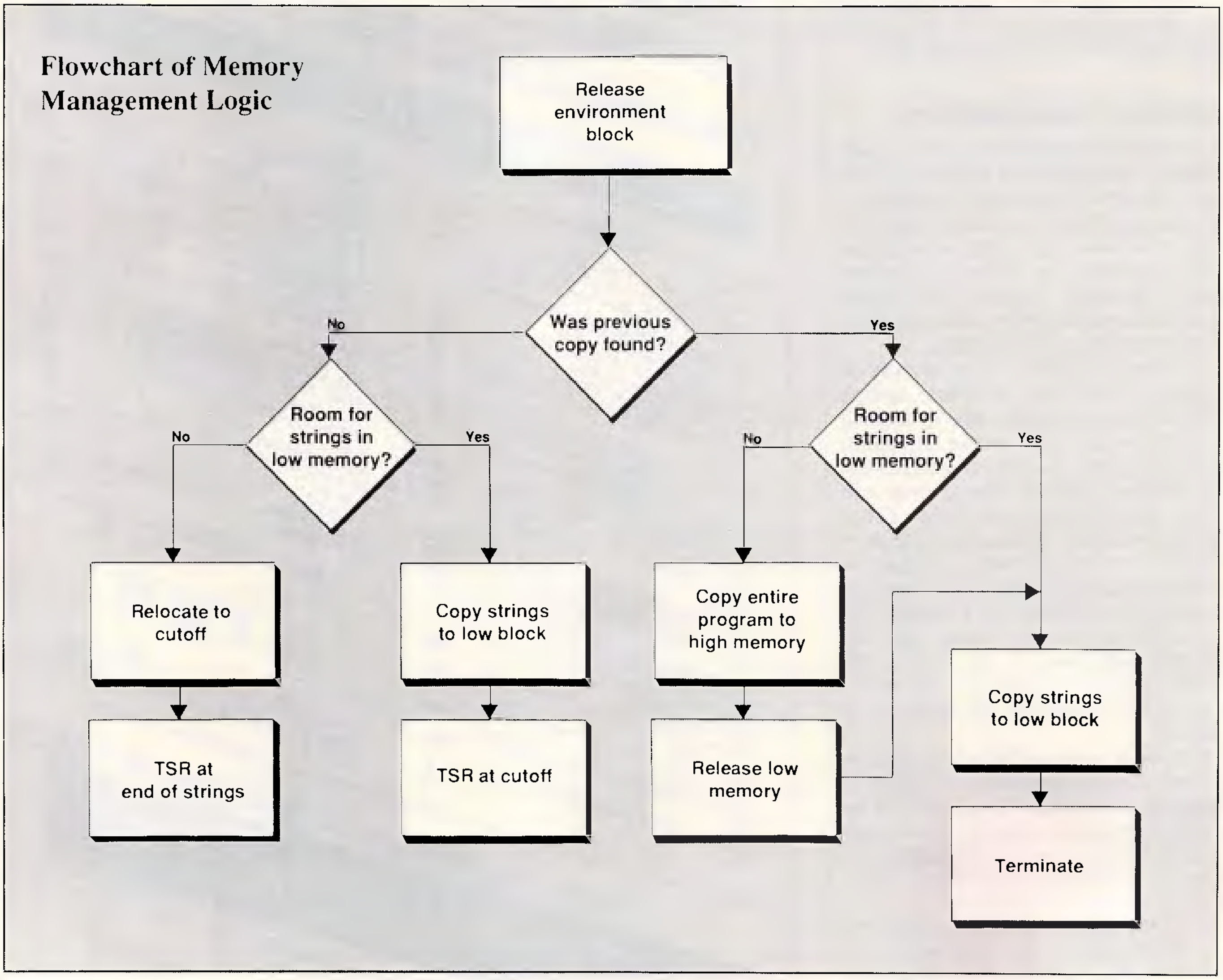
Next, the tried and true method of scanning memory is used to search for a previously installed copy of ASPRN. If no previous copy is found, the procedure FIND_LOW attempts to locate a block of memory of sufficient size at a lower address. If a large enough block is found, the strings are copied to the new, lower block. If no room is found, ASPRN relocates the string block down to the area just following the label CUTOFF. In either case, the program is terminated with a call to the old faithful interrupt 21h function 31h, terminate and stay resident.

If, on the other hand, a previous copy is found, the old block of strings is freed so that it may be reallocated. If the old strings had been located at CUTOFF in the previous load, the resident portion of ASPRN is shrunk further to the label MINIMUM. The search for a suitable block in low memory is again performed, and if one is found, the strings are copied and the program terminates, which leaves only strings themselves resident.

Later copies of the program serve no purpose beyond loading the new string blocks, and should therefore leave no code in memory. If room cannot be found in memory that is lower than the current copy of the program, drastic measures are taken: ASPRN reduplicates itself at a higher address, jumps up to that copy, then frees the memory occupied by the code it just left. Since the newly freed memory block was large enough to contain both the strings and the program, the next call to allocate a block large enough for the strings cannot fail. The strings are copied, and the program terminates. In each case when strings are loaded and relocated, the pointer in the memory-resident macro expander is updated to reflect the new location of the strings.

Conclusion

Whether you're a laser user or not, the


Flowchart of Memory Management Logic
Release environment block
Was previous copy found?
No
Yes
Room for strings in low memory?
No
Yes
Room for strings in low memory?
No
Yes
Relocate to cutoff
TSR at end of strings
Copy strings to low block
TSR at cutoff
Copy entire program to high memory
Release low memory
Copy strings to low block
Terminate

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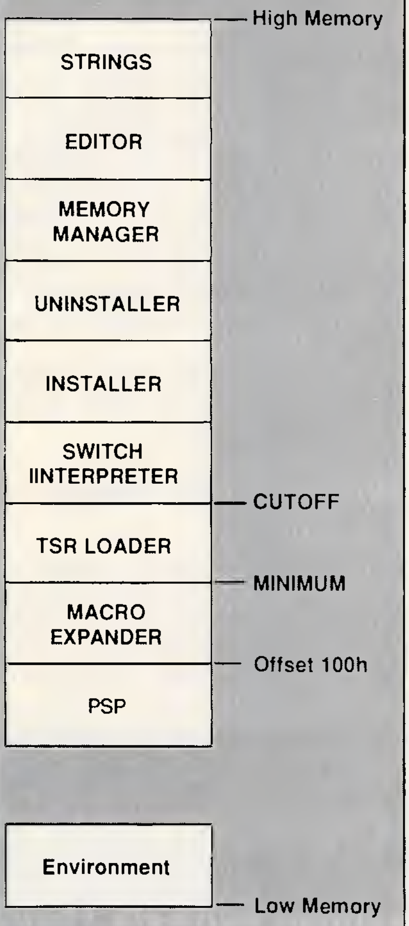

When ASPRN is executed by DOS, its image in memory can be represented by the above layout. Each of the modules corresponds to one or more procedures in the source code listing.

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The memory-handling routines used in ASPRN can serve as a model for utilities you would like to write. They also serve as a monument to the primitive tools provided by DOS. Without inside knowledge and undocumented functions, no memory management would be possible. So no matter what your interest, ASPRN is good for what ails you.

END

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CT1188 UPDATE

Continued from Page 94

and Xywrite. It was interesting to see how much space had to be allocated to the same file for the different word processors. I was amazed to see that WordPerfect's file was slightly smaller than straight ASCII — it was 186,157 bytes. The file in MultiMate was 390,144 and, in DisplayWrite, it was a huge 606,720. I can only guess that this huge overhead must result in a much more graphically sophisticated display.

Anyone who wonders if they have enough insurance would find the 'household inventory' useful. It takes you round the house, room by room, suggesting all the things you might have in each. Boxes are provided to let you fill in the date purchased, quantity, cost and present value. That's where I was when I looked up 'bedding' and received the astonishing response. I also learnt that it is common for American households to have a mangle in the basement. Once again, the search arguments have to be precise.

ZIP codes

Just before Christmas, I must have spent an hour looking for the ZIP code of a friend in America. Bookshelf would have found it in seconds. The program automatically checks the address, providing you are very careful how you type it into your word processor. The entire street and apartment number details must appear on one line, while the town and state have to be on the line below with a single space following the town name. Leave the cursor after the state name or code, so that the ZIP code can be inserted into your document. Here's an example that worked:

Mickey Mouse
Apartment B3, 209 Lakeview Drive
Redwood City, California

Bookshelf pasted in an accurate '94062' in six seconds. I tried non-existent addresses in the same street and Bookshelf knew that the house numbers were out of range. The California ZIP code file takes just over half a megabyte, New York state takes over 2Mbytes, while poor old Guam rates just 29k.

Usage alert

If you have a word you're not sure about — a lot of people confuse 'stationery' and 'stationary', for example — simply position the cursor on the word you've chosen, go into 'Usage', and you will see the similar words and a quick reminder of their meanings. The two I chose were described as 'paper' and 'unmoving'.

You can check the entire screen and, every time a word is in doubt, you are given the option to replace it or leave it alone. The problem is that Bookshelf hands on to its own dialogue box display and doesn't let you see where in the text the word lies. Once you've accepted or rejected a word, the dialogue box clears and you can actually see the word being replaced in your document. By then, though, it's too late if you've made the wrong choice. It will also waste time replacing a word in your text even when you've selected the same spelling.

It's a pity that such an advanced medium has been let down by such sloppy programming.

Business information sources

If you have a business problem — maybe it's staff motivation or where and how to raise money — this part of Bookshelf will help you home in on the right sources of advice. All the informa-

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tion sources are described in some detail, so you can make a fairly good judgement of where to go for that missing information.

Documentation

The *User's Guide* is a work of art. It's printed on good-quality paper, is 65 pages long, and is filled with jazzy graphics. It looks wonderful but it's not actually that good. It gets you going though. The accompanying *Quick Reference Guide* — 21 pages of approximately A5 size — is just that, a quick reference. I felt that a real reference section in the *User's Guide* was desperately needed.

Conclusion

This is just the first step on a long road. The potential of this medium is huge for any kind of information which needs to be accessed in fairly small chunks. At the likely asking price starting from around $1600, depending on the CD-ROM chosen, for a complete system you would have to be pretty serious about needing information on tap like this; but, as the range of CD-ROM reference disks grows and the cost of players drops, I can see this becoming a very attractive way of accessing information.

Bookshelf is a worthwhile first product but it is definitely ragged around the edges. The product is inconsistent, especially the intelligence of the various sections. Simply to match text strings is not good enough when other applications in the same suite can display so much more native wit.

END

Watch future issues of APC for details of distributors. Space-Time is on (03) 813 3211.

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TJ'S WORKSHOP

APC's monthly pot-pourri of hardware and software productivity tips. APC will pay between $100 and $200 for each tip published. Write to TJ's Workshop, APC, 124 Castlereagh Street, Sydney 2000.

Keyclick toggler

When I moved up from my previous personal computer to an XT, I missed the ability to toggle keyboard clicking off and on, so I wrote CLICKER.COM, created from the CLICKER.ASM assembly code in Fig 1 or the Basic CLICKER.BAS program in Fig 1(a). Once you create it, load CLICKER from the DOS level, and you'll hear a click each time you press an alphanumeric key. You can toggle the clicking sound off and on by pressing Ctrl-Alt-Ins at any time.

CLICKER intercepts interrupt 9 and toggles the speaker bit every time a key is newly pressed. It does not click on either of the Shift keys, the Ctrl key, or the Alt key, and it passes all keys through unaltered.

To change the hotkey toggle, change the variable hot_key in the CLICKER.ASM equate area to be the scan code of whatever key you want to use. Since the Ins key is right next to the Del key, there's an obvious risk in getting Ctrl-Alt-Del when you just want to turn off clicking. Remember that since CLICKER starts clicking as soon as it is installed, you may never need to use the hotkey toggle.

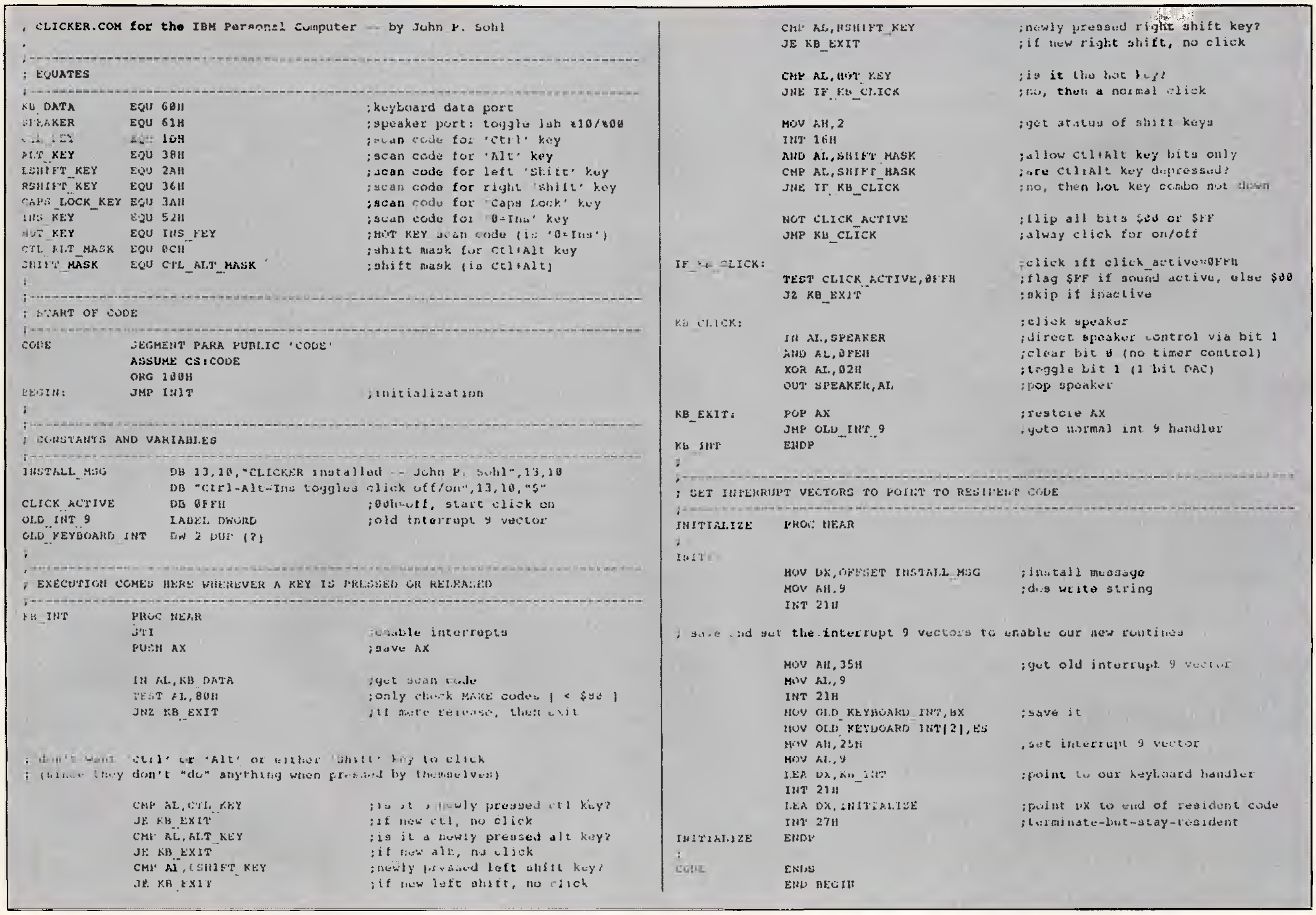
CLICKER does not check to see if it is installed already, so it's possible to invoke it more than once. Interestingly, the click timbre changes depending on whether it's been installed an odd or even number of times.

J Sohl

We receive lots of keyclick programs, but this one's different since you can toggle it on and off. Be careful if you try using it with SideKick or any other program that's greedy about Int 9 — PS.

Path magic

Just about every hard disk user ends up battling the DOS PATH. Since many users keep data directories one level down from the programs that use the



```
, CLICKER.COM for the IBM Personal Computer -- by John P. Sohl
,
;----------------------------------------------------------------------
; EQUATES
;----------------------------------------------------------------------
KB_DATA         EQU 60H                 ;keyboard data port
SPEAKER         EQU 61H                 ;speaker port: toggle lsb $10/$00
CTL_KEY         EQU 1DH                 ;scan code for 'Ctrl' key
ALT_KEY         EQU 38H                 ;scan code for 'Alt' key
LSHIFT_KEY      EQU 2AH                 ;scan code for left 'Shift' key
RSHIFT_KEY      EQU 36H                 ;scan code for right 'Shift' key
CAPS_LOCK_KEY EQU 3AH                   ;scan code for 'Caps Lock' key
INS_KEY         EQU 52H                 ;scan code for '0-Ins' key
HOT_KEY         EQU INS_FEY             ;HOT KEY scan code (is '0-Ins')
CTL_ALT_MASK    EQU 0CH                 ;shift mask for Ctl+Alt key
SHIFT_MASK      EQU CTL_ALT_MASK        ;shift mask (is Ctl+Alt)
;
;----------------------------------------------------------------------
; START OF CODE
;----------------------------------------------------------------------
CODE            SEGMENT PARA PUBLIC 'CODE'
                ASSUME CS:CODE
                ORG 100H
BEGIN:          JMP INIT                ;initialization
;
;----------------------------------------------------------------------
; CONSTANTS AND VARIABLES
;----------------------------------------------------------------------
INSTALL_MSG         DB 13,10,"CLICKER installed -- John P. Sohl",13,10
                    DB "Ctrl-Alt-Ins toggles click off/on",13,10,"$"
CLICK_ACTIVE        DB 0FFH             ;00h=off, start click on
OLD_INT_9           LABEL DWORD         ;old interrupt 9 vector
OLD_KEYBOARD_INT    DW 2 DUP (?)
;
;----------------------------------------------------------------------
; EXECUTION COMES HERE WHEREVER A KEY IS PRESSED OR RELEASED
;----------------------------------------------------------------------
KB_INT          PROC NEAR
                STI                     ;enable interrupts
                PUSH AX                 ;save AX

                IN AL,KB_DATA           ;get scan code
                TEST AL,80H             ;only check MAKE codes ( < $80 )
                JNZ KB_EXIT             ;if mere release, then exit


; don't want 'ctrl' or 'Alt' or either 'Shift' key to click
; (since they don't "do" anything when pressed by themselves)

                CMP AL,CTL_KEY          ;is it a newly pressed ctl key?
                JE KB_EXIT              ;if new ctl, no click
                CMP AL,ALT_KEY          ;is it a newly pressed alt key?
                JE KB_EXIT              ;if new alt, no click
                CMP AL,LSHIFT_KEY       ;newly pressed left shift key?
                JE KB_EXIT              ;if new left shift, no click
                CMP AL,RSHIFT_KEY       ;newly pressed right shift key?
                JE KB_EXIT              ;if new right shift, no click

                CMP AL,HOT_KEY          ;is it the hot key?
                JNE IF_KB_CLICK         ;no, then a normal click

                MOV AH,2                ;get status of shift keys
                INT 16H
                AND AL,SHIFT_MASK       ;allow Ctl+Alt key bits only
                CMP AL,SHIFT_MASK       ;are Ctl+Alt key depressed?
                JNE IF_KB_CLICK         ;no, then hot key combo not down

                NOT CLICK_ACTIVE        ;flip all bits $00 or $FF
                JMP KB_CLICK            ;alway click for on/off

IF_KB_CLICK:                            ;click iff click_active=0FFH
                TEST CLICK_ACTIVE,0FFH  ;flag $FF if sound active, else $00
                JZ KB_EXIT              ;skip if inactive

KB_CLICK:                               ;click speaker
                IN AL,SPEAKER           ;direct speaker control via bit 1
                AND AL,0FEH             ;clear bit 0 (no timer control)
                XOR AL,02H              ;toggle bit 1 (1 bit DAC)
                OUT SPEAKER,AL          ;pop speaker

KB_EXIT:        POP AX                  ;restore AX
                JMP OLD_INT_9           ;goto normal int 9 handler
KB_INT          ENDP
;
;----------------------------------------------------------------------
; SET INTERRUPT VECTORS TO POINT TO RESIDENT CODE
;----------------------------------------------------------------------
INITIALIZE      PROC NEAR
;
INIT:
                MOV DX,OFFSET INSTALL_MSG       ;install message
                MOV AH,9                        ;dos write string
                INT 21H

; save and set the interrupt 9 vectors to enable our new routines

                MOV AH,35H                      ;get old interrupt 9 vector
                MOV AL,9
                INT 21H
                MOV OLD_KEYBOARD_INT,BX         ;save it
                MOV OLD_KEYBOARD_INT[2],ES
                MOV AH,25H                      ;set interrupt 9 vector
                MOV AL,9
                LEA DX,KB_INT                   ;point to our keyboard handler
                INT 21H
                LEA DX,INITIALIZE               ;point DX to end of resident code
                INT 27H                         ;terminate-but-stay-resident
INITIALIZE      ENDP
;
CODE            ENDS
                END BEGIN
```

Fig 1 CLICKER.ASM source code to create CLICKER.COM

data, one way to make life easier is to include a '..' in your PATH. My own PATH begins with D:\;..;C:\; so DOS can always try to look one level higher no matter where I am in the subdirectory structure.

But what users really need is a PATH editor to let them add or remove subdirectories temporarily. I've created a series of batch files to do just that. To use them, simply type the following all on one line with a single space after SUB DIR:

```
[d:][path]CHPATH SUBDIR [-B
|  -E  |  -DB  |  -DE]
```

where [d:][path]CHPATH is the name of the main batch file, SUBDIR is the subdirectory on which to act, -B will add the specified subdirectory to the beginning of the existing PATH, -E will add the specified subdirectory to the end of the existing PATH, -DB will delete from the current PATH all subdirectories up to and including the specified subdirectory, and -DE will delete from the current PATH all subdirectories after the specified subdirectory.

For example, if your PATH is C:\111;C:\222;C:\333; and you entered

```
CHPATH  C:\444  -E
```

you'd end up with C:\111;C:\222;C:\333;C:\444;. If you started with the same PATH but entered

```
CHPATH C:\444 -B
```

you'd end up with C:\444;C:\111;C:\222;C:\333;. If you started with C:\111;C:\222;C:\333;C:\444; and you entered

```
CHPATH  C:\222 -DB
```

you'd end up with C:\333;C:\444;. If you started with the same C:\111;C:\222;C:\333;C:\444; and you entered

```
CHPATH  C:\222 -DE
```

you'd end up with just C:\111.
You'll actually need all three batch files in Fig 2: the main CHPATH.BAT, CPSET1.BAT (whose only purpose is to invert the order of the PATH entries), and CPSET2.BAT to handle the trickier delete-to-beginning and delete-to-end operations.

T Burt

These are all very useful — and sorely needed — utilities. About the only drawback is that when you want to delete subdirectories, you have to type them uppercase, exactly the way they appear in the PATH. So if a subdirectory is C:\SK and you type in c:\sk or just \SK, it won't work properly. You should also note that, as the programs are currently written, you will be unable to use the delete-to-end or delete-to-beginning functions successfully if you have more than nine subdirectories in your PATH.

We adapted the batch files to make them case insensitive and added a new -1 command to let you remove a single subdirectory inside the current PATH. If your current PATH is C:\111;C:\222;C:\333;C:\444; and you entered

```
CHPATH  C:\333 -I
```

you'd end up with just C:\111;C\222;C:\444;. We also added a line in CHPATH.BAT that creates a file called RESET.BAT. To reset your PATH the way it was before you made any changes, just type RESET — PS.

```
100 ' Program to create CLICKER.COM -- by John P. Sohl
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 12:FOR C=1 TO 16:READ A$:T=T+VAL("&H"+A$):NEXT
130 READ S:IF S<>T THEN PRINT "ERROR IN LINE";B*10+180:END
140 T=0:NEXT:RESTORE
150 OPEN "CLICKER.COM" AS #1 LEN=1:FIELD #1,1 AS D$
160 FOR B=1 TO 12:FOR C=1 TO 16:READ A$
170 LSET D$=CHR$(VAL("&H"+A$)):PUT #1:NEXT:READ DUMMY$:NEXT
180 CLOSE:PRINT "CLICKER.COM CREATED"
190 DATA E9,92,00,0D,0A,43,4C,49,43,4B,45,52,20,69,6E,73,1273
200 DATA 74,61,6C,6C,65,64,20,2D,2D,20,4A,6F,68,6E,20,50,1295
210 DATA 2E,20,53,6F,68,6C,0D,0A,43,74,72,6C,2D,41,6C,74,1246
220 DATA 2D,49,6E,73,20,74,6F,67,67,6C,65,73,20,63,6C,69,1476
230 DATA 63,6B,20,6F,66,66,2F,6F,6E,0D,0A,24,FF,00,00,00,1135
240 DATA 00,FB,50,E4,60,A8,80,75,36,3C,1D,74,32,3C,38,74,1609
250 DATA 2E,3C,2A,74,2A,3C,36,74,26,3C,52,75,12,B4,02,CD,1238
260 DATA 16,24,0C,3C,0C,75,08,2E,F6,16,4C,01,EB,09,90,2E,1092
270 DATA F6,06,4C,01,FF,74,08,E4,61,24,FE,34,02,E6,61,58,1792
280 DATA 2E,FF,2E,4D,01,BA,03,01,B4,09,CD,21,B4,35,B0,09,1460
290 DATA CD,21,2E,89,1E,4D,01,2E,8C,06,4F,01,B4,25,B0,09,1203
300 DATA 8D,16,51,01,CD,21,8D,16,95,01,CD,27,00,00,00,00,1040
```

Fig 1(a) Basic CLICKER.BAS program to create CLICKER.COM

```
ECHO OFF
REM CHPATH.BAT
IF %2!==! GOTO ERROR
PATH > RESET.BAT
SET M=%1
SET P=%2
IF !%2==!-DB CPSET1 %PATH%
IF !%2==!-db CPSET1 %PATH%
IF !%2==!-DE CPSET2 %PATH%
IF !%2==!-de CPSET2 %PATH%
IF !%2==!-I CPSET3 %PATH%
IF !%2==!-i CPSET3 %PATH%
SET P=
SET M=
IF !%2==!-B PATH=%1;%PATH%
IF !%2==!-b PATH=%1;%PATH%
IF !%2==!-E PATH=%PATH%;%1
IF !%2==!-e PATH=%PATH%;%1
PATH
GOTO END
:ERROR
ECHO Current path is:
PATH
ECHO Proper syntax is:
ECHO %0 DIRECTORY [-B -E -I -DB -DE]
:END

REM CPSET1.BAT
CPSET2 %9;%8;%7;%6;%5;%4;%3;%2;%1;
```

```
ECHO OFF
REM CPSET2.BAT
SET PATH=
:LOOP
IF !%P%==!-DB PATH=%1;%PATH%
IF !%P%==!-db PATH=%1;%PATH%
IF !%P%==!-DE PATH=%PATH%%1;
IF !%P%==!-de PATH=%PATH%%1;
SHIFT
IF NOT !%1==! IF NOT !%1==!%M% GOTO LOOP
SET M=
SET P=
PATH


ECHO OFF
REM CPSET3.BAT
SET PATH=
:LOOP
IF NOT %1==%M% PATH=%PATH%%1;
SHIFT
IF NOT !%1==! GOTO LOOP
SET M=
SET P=
PATH
```

Fig 2 CHPATH.BAT, CPSET1.BAT, CPSET2.BAT, and CPSET3.BAT batch files to edit PATHs. Once you've created them, type CHPATH for the proper syntax

There are three roads to multi-user computing. Only one can guarantee a smooth trip.

Businesses, big and small, have come to rely on Personal Computers. Few can get by with just one. As you exploit the potential of your PCs, the demand for more computing power, storage and terminals will grow too. But bigger systems can also lead to problems if you choose the wrong growth path:

Does your system stall in heavy traffic?

How are file backups handled?

Will single user software work reliably with more than one user?

Is further expansion expensive?

CAUTION

There are at least three ways to build a mult-user PC system — Unix/Xenix, a Local Area Network, a clustered CPU system.

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Local Area Networking

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EGA screen printing

Because the screen memory on an EGA display adaptor is stored in contiguous memory (as opposed to the odd/even arrangement used by the CGA), it is fairly simple to do a high-resolution screen dump to an HP LaserJet printer. However, most approaches using Basic involve multiple loops to PEEK at the display memory, which takes a long time.

The EGA screen routine listed in Fig 3 takes advantage of two shortcuts to copy a full screen very quickly. First, BSaving the screen image to disk occurs extremely fast, even though it will require subsequent processing to add the HP graphics commands. Second, by using Shell, the final downloadable file can be copied to the printer directly through DOS, thereby avoiding LPrint, which is also slow.

C Popolo

Mr Popolo's original program cleverly used BSave to bypass a bunch of slow Peeks, but it didn't go far enough. I rewrote it as a callable subprogram and speeded things up by using BLoad to get the BSaved data into a string.

This is a very powerful technique that is often overlooked. When you need to save or retrieve all of the data in a numeric array, don't write it to a sequential file using Print statements. A much better approach is to BSave a memory image of the data onto disk. When your program needs to retrieve the information later, simply dimension an array, find where it is in memory, and BLoad the file there.

The example in Fig 4 determines the correct array size and then loads some previously saved data.

Print and Input are two of Basic's slowest commands, and any excuse to avoid them is warranted. A BSaved array can be written to disk more than 20 times faster than a file created using Print # statements. And though text files can't be BSaved or BLoaded like numeric arrays, writing a random file with LSet and Put will also be much faster than using Print — EW.

No_cursor Clipper

An undocumented feature of Clipper lets you turn the cursor off (then on) when doing screen manipulations or INKEY () loops. To hide the cursor:

```
CALL _ SETCTYP WITH WORD ( 0 )
```

To unhide it:

```
CALL _ SETCTYP WITH WORD ( 1 )
```

```
Screen 9
For X = 1 To 150 step 2.5                  'display a test pattern
    Line(X + 300, X) - (300-X, 300-X). 7, B
Next
Call EGA.HP
End

Sub EGA.HP Static

    EGALength - 28000                      'size of EGA memory
    Def Seg = &HA000                       'EGA screen segment
    BSave "$Tmp.Tm1", 0, EGALength         'BSave the screen image

    E$ = Chr$(27)                          'Escape
    Hdr$ = E$ + "*t75R"                    '75 dpi resolution
    Hdr$ = Hdr$ + E$ + "*r1A"              'initialize graphics

    EGAData$ = Space$(EGALength)           'room for screen image
    Def Seg
    BLoad "$Tmp.Tm1", SAdd(EGAData$)       'BLoad it into EGAData$

    Open "$Tmp.Tm2" As #99 Len = 86        '99 should be safe numbe
    Field #99, 6 As Start$, 80 As Dat$
    LSet Start$ = E$ + "*b80W"             'start graphics command

    For X = 1 To EGALength Step 80         'create the image file
        LSet Dat$ = Mid$(EGAData$, X, 80)
        Put #99
    Next
    Close #99

    LPrint Hdr$;                           'LPrint header directly
    Shell "Copy $Tmp.Tm2/B LPT1: >NUL:"    'copy the data
    LPrint E$ "*rB" E$ "E";                'end-of-graphics + reset

    Kill "$Tmp.Tm?"                        'delete temporary files

End Sub
```

Fig 3 A Basic subprogram to print EGA graphics on an HP LaserJet

D Domzalski

Hiding the cursor can sometimes add elegance to a screen (Nantucket used _SETCTYP in some of its own menuing code). Why then was a valuable feature left undocumented for Mr Domzalski to find? The best explanation I've found is that if a program is aborted (for whatever reason) while the cursor is off, it remains off when you land in DOS. Most end users won't know how to deal with this. For the programmer, too, losing the cursor is an added frustration during program development, when glitches and gremlins spontaneously materialise from within thoroughly checked and absolutely bullet-proof code.

Clipper's new version (originally to have been released in summer '87, and now expected early in 1988) produces a syntax error if you call _SETCTYP. Much better, however, it provides the calls SET CURSOR OFF and SET CURSOR ON. And in the new version, if you abort a program with the cursor off, Clip-

```
Open FileName$ As #99 Len = 1           'open to get the length
ReDim Array%(Lof(99) / 2)               'calc array size, each
Close #99                               '  element holds 2 bytes
Def Seg                                 'use default segment
BLoad FileName$, VarPtr(Array%(0))      'load the data
```

Fig 4 Basic's BLoad is much faster than using Input

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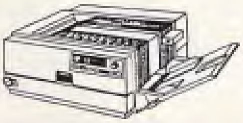

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```
PROGRAM ExternalFileCreator;
VAR
  X : Integer;
  PROCEDURE ExternalProc(P : Integer);
  (* THIS procedure will be made external *)
  BEGIN
    Write('I am the famous External Procedure, ');
    WriteLn('called with parameter ', P);
    WriteLn('I know that global variable X has value ', X);
  END;

  PROCEDURE OtherProc(P : integer);  (* THIS procedure will be made external *)
  BEGIN
    WriteLn('OtherProc is now calling ExternalProc');
    ExternalProc(P);
  END;

  PROCEDURE Dummy; BEGIN END;
    { Dummy procedure to mark the end of the ExternalProcedure. }

  PROCEDURE SaveExternal;
  CONST
    BufferSize = $1000;
  VAR
    Start, Finish : Integer;  {addresses}
    Size          : Integer;
    buffer        : ARRAY[0..BufferSize] OF Byte;
```

continued...

Fig 5 Program to make two procedures into an external file

per *cleans up and restores the cursor at the DOS prompt — BS.*

Adding external procedures

I read an ad for a program called Turbo Optimiser that claimed it could save compiled Turbo Pascal procedures to be used later as external procedures. I thought this was a great idea, so I took a few minutes to implement my own version.

The example program in Fig 5 finds the beginning of the procedure and the start of the dummy procedure that follows it using the Ofs function. That portion of the code is then written to disk.

There are limitations to using this technique. The extracted procedure cannot call other procedures because it no longer knows where they will be. It can use global variables, but they must be declared at the beginning of the new program in the exact order they were declared in the original program. The external procedure must be the first procedure in the new program.

You could modify this technique to allow more than one procedure in the external file. Turbo Pascal does this with the GRAPH.P and GRAPH.BIN files.

I salute the Turbo Optimiser people for this inspiration. My only question is, why didn't anyone think of it sooner?

W Haselton

This technique doesn't replace the Turbo Object Librarian, but it can save compile time. It is easy to add more procedures to the external file — I took the liberty of modifying the sample program to do just that. You need the offset in bytes from the start of the first procedure to the start of each of the others. In this case, there's just one other and it begins 170 bytes after the first. When

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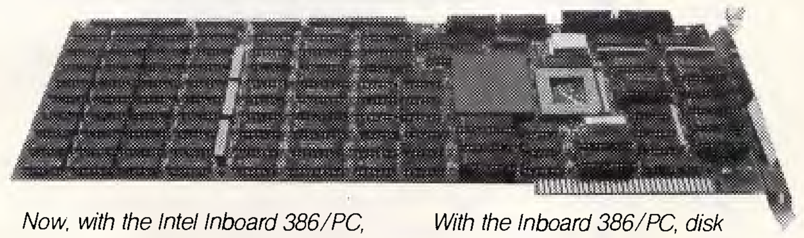

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fig 5 cont

```
    Target          : FILE;
  BEGIN
    Start  := Ofs(ExternalProc);
    Finish := Ofs(Dummy);
    Size := Finish-Start;
    IF Size > BufferSize THEN
      BEGIN
        WriteLn('Procedure is too big.');
        WriteLn('Buffer is ', BufferSize, ' bytes.');
        WriteLn('Procedure is ', Size, ' bytes.');
        Halt;
      END;
    Assign(Target, 'EXTERNAL.BIN');
    WriteLn('Writing output to EXTERNAL.BIN');
    ReWrite(Target, 1);
    Move(Mem[CSeg:Start], buffer, Size);
    BlockWrite(Target, buffer, Size);
    Close(Target);
    Write('Offset of "OtherProc" is ');
    WriteLn(ofs(OtherProc) - Start);
  END;

BEGIN
  SaveExternal;
END.
```

you declare these procedures as external (see Fig 6), only the first one refers directly to the file. You declare the rest as offsets from the first — NR.

Mac Word

Even though Word 3.01 on the Mac is much faster than earlier versions at redrawing the screen, it can take many long seconds to redraw a complex graphic, especially one that has had smoothing activated for its curves. The best way to avoid this problem during a long editing session is to create a special Graphics style for each graphic and include Hidden as one of its characteristics. Be sure that your Preferences setting has SHOW HIDDEN TEXT set to OFF. Now you can quickly scroll through and edit text in the document. Just remember to redefine your Graphics style by cancelling the Hidden characteristic before repaginating or printing.

R Hathcock

FileMaker Plus

Sometimes you need to print the records in your database starting in the middle (the printer may have jammed or run out of paper). The most direct way to do this is to just run the report again, and put the number of the first incomplete page in the Print Form box in the Print dialog. However, sometimes you don't know the page to start on.

Another way to the same result is to use the OMIT RECORDS command to remove all the records that you have already printed from the current set of found records.

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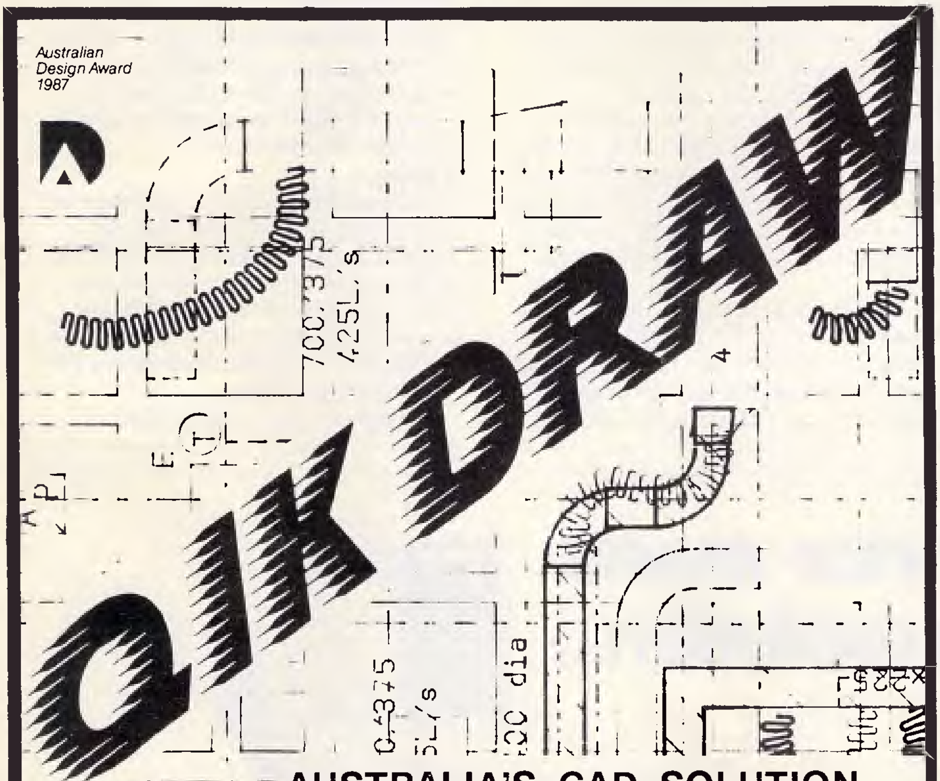

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```
PROGRAM ExternalFileDemo;
VAR
  X : Integer;                (* Do NOT put anything before X!*)
  Y : Integer;

  PROCEDURE ExternalProc(P : Integer); EXTERNAL 'external.bin';
  PROCEDURE OtherProc(P : Integer); EXTERNAL ExternalProc[170];
  (* Before you try to compile this, you must create EXTERNAL.BIN*)
BEGIN
  Write('What value shall I give to X? '); ReadLn(X);
  Write('What value shall I pass to the procedure? '); ReadLn(Y);
  OtherProc(Y);
END.
```

Fig 6 Demonstrating the use of the external file

from the record number of the first record you want to print, and enter that number in the dialog. This will omit (not delete) all records up to the one you want to start printing from. Now just choose PRINT.

This method should not be used if you're restarting a report that uses Grand Totals, as FileMaker Plus will exclude the omitted records from the totals.

The technique is very useful for printing simple listings and labels. It's also a convenient way to print records in a sorted set starting from the middle (for example, you can print M to Z of a directory).

A Shaw

EGA-aware more

The DOS MORE filter pauses every 25 lines even though the EGA is capable of displaying more. But it's possible to patch MORE.COM (Version 3.1 or later) to handle this. Just type the EGAMORE.SCR script in Fig 7. The addresses in this script are for Version 3.3 only; for Versions 3.1 and 3.2, note the slightly different offsets mentioned after the semicolons on some of the lines.

Type in the script using a pure ASCII word processor, or EDLIN, or the DOS COPY CON command (and make sure you're entering the right addresses and values for your particular version of DOS). Hit the Enter key after each line, especially the last one with the Q. And be sure to leave the four blank lines; this won't work without them. Then put EGAMORE.SCR in the same directory as your DOS MORE.COM and type

```
DEBUG < EGAMORE.SCR
```

The script will create a new DOS-version-specific copy of MORE.COM called EGAMORE.COM.

This patch is useful for EGA systems because it uses the character generator routine provided by INT 10 to figure out the proper number of rows. The patch codes are located where the ' — More — ' message was. EGAMORE.COM will beep instead of printing this message. Finally, this patch increases the size of the buffer from 4k to 32k.

J Chin

All utilities should use this technique to sniff out the actual screen size. But, regrettably, few do. Worse, most DOS utilities don't. Shameful. Be sure you don't have ANSI.SYS loaded, by the way, when you try to expand your EGA screen size, since ANSI hard-wires the screen size to 25 lines.

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```
N MORE.COM
L
A 112                           ;use 114 for DOS 3.1 and 3.2
JMP 1EE                         ;jmp to patch code
NOP
NOP

A 1EE                           ;same for DOS 3.1 and 3.2
MOV AX,1130                     ;invoke video BIOS character generator
INT 10                          ;routine to return information; current
INC DL                          ;number of rows returns in DL
MOV [1E5],DL                    ;use [1E7] for DOS 3.1 and 3.2
JMP 117                         ;use 119 for DOS 3.1 and 3.2

A 1BA                           ;use 1BC for DOS 3.1 and 3.2
JBE 1DC                         ;use 1DE for DOS 3.1 and 3.2
MOV DL,7                        ;change code to issue beep
MOV AH,2                        ;instead of -- More --
INT 21
NOP

A 1C9                           ;use 1CB for DOS 3.1 and 3.2
MOV DL,D                        ;send carriage return only
MOV AH,2                        ;to save one line
INT 21
```

continued...

Fig 7 EGAMORE.SCR to patch MORE.COM, Versions 3.1 through 3.3, so that it's aware of the actual screen size. Type in the script using a pure-ASCII word processor, EDLIN, or the DOS COPY CON command (and make sure you're entering the right addresses and values for your particular version of DOS). Hit the Enter key after each line, especially the last one with the Q. And be sure to leave the four blank lines; this won't work without them. Then put EGAMORE.SCR in the same directory as your DOS MORE.COM and type DEBUG < EGAMORE.SCR

program in Fig 8 to create a file called CLSEGA.COM that will clear an EGA screen to blue text on a 43-row white background. To patch the colour once you've created the file, change the byte at address 12A. The left-hand digit represents the background and the right-hand digit the foreground changing it from the existing 71 to 25 would produce purple text on a green background.

See the following letter for another 43-line patch.

Longer EDLIN displays

The EDLIN P (Page) command displays just 23 lines when entered without arguments. By changing the line count byte, it's possible to have EDLIN display any number of lines from 1 to 128. I've altered the P command to display 41 lines when I use EDLIN in the EGA's 43-line mode. This patch affects the P command only.

The address of the line count byte varies according to the DOS version:

Version	Offset
2.0	700
2.1	700
3.0	102B

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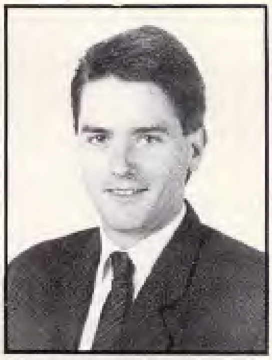
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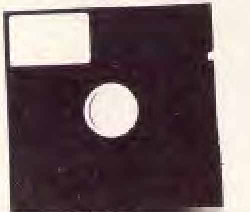

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The default value at this address is 16, since this is part of the instruction:

```
ADD     DX,+16
```

The value of this byte cannot exceed 7Fh (unless you want your whole document to streak past). Values lower than 16h will cause the P command to display fewer than 23 lines. Note that the actual number of lines EDLIN will display is one greater than the value at this byte.

No. of lines displayed	Value at offset
25	16
35	20
43	28

— JB.

Hiding the dBASE cursor

There are times when a flashing cursor is about as undesirable as another man's word processor, so I wrote the small assembly program shown in Fig 9 to turn the cursor off or on in dBASE III PLUS programs. It's especially useful with a light-bar menu (or any other INKEY () loop) and with windowed error messages.

CURSHIDE.BIN uses a semidocumented feature of the IBM ROM BIOS. When setting the cursor type using the video interrupt, IBM states, "setting bit 5 or 6 [of the cursor start line register] will cause erratic blinking or no cursor at all." A little experimentation shows that if bit 5 is set, the cursor stops flashing. It remains in the same position and the video output is not affected. CURSHIDE sets or clears bit 5 and does not affect the cursor shape.

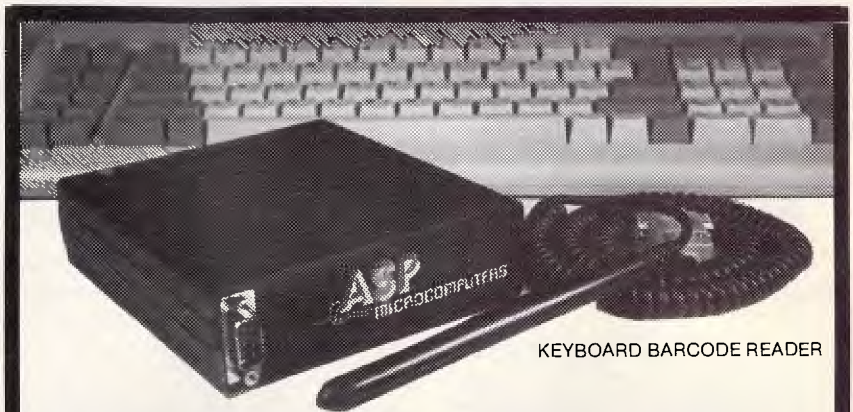
Using the IBM or Microsoft macro assembler, you can create the necessary binary file from the assembly language listing using the following commands:

```
MASM CURSHIDE
LINK CURSHIDE
EXE2BIN CURSHIDE
```

Ignore the 'no stack segment' warning you get after the linking step. The file CURSHIDE.BIN can now be used with dBASE III Plus using this convention:

```
LOAD CURSHIDE  && starting
program
CALL CURSHIDE WITH '0'  &&
hide
RELEASE CURSHIDE  && exiting
program
```

```
NOP
E 13F 80                          ;use 141 for DOS 3.1 and 3.2
N EGAMORE.COM                     ;increase buffer size to 32K
W
Q
```



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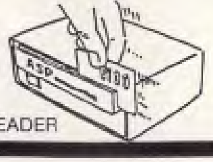

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The RELEASE command should only be used to free up memory at the end of a program. If it is executed when the cursor is hidden, you will not be able to restore the cursor without LOADing the program again.

T Sanderson

The dBASE III Plus manual contains a perfect example of when to use CURSHIDE, in demonstrating the INKEY() function (page 6-30). A DO WHILE displays the time in the upper-left corner while awaiting the user's menu choice:

```
i  =  0
DO  WHILE  i  =  0
@  1, 72  SAY TIME ()
i  =  INKEY ()
ENDDO
```

If you run this code in dBASE, the cursor leaps wildly back and forth — looking at it day after day would drive some of us crazy. CALLing CURSHIDE does the trick.

CURSHIDE is also very compact. LOADing CURSHIDE uses only 16 bytes of memory. Many other programs should be able to LOAD and CALL CURSHIDE as well — BS.

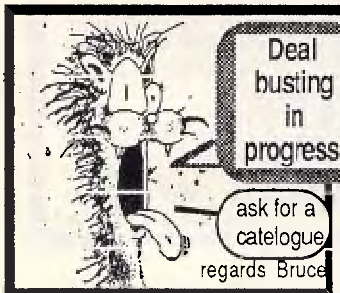
END

```
100 ' CLSEGA.BAS program to create CLSEGA.COM
110 E=16:CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 5:FOR C=1 TO 16:READ A$:T=T+VAL("&H"+A$):NEXT
130 READ S:IF S<>T THEN PRINT "ERROR IN LINE";B*10+180:END
140 T=0:NEXT:RESTORE:OPEN "CLSEGA.COM" AS #1 LEN=1
150 FIELD #1,1 AS D$:FOR B=1 TO 5:FOR C=1 TO 16:READ A$
160 LSET D$=CHR$(VAL("&H"+A$)):PUT #1:IF B=5 AND C=E THEN 180
170 NEXT:READ F$:NEXT
180 CLOSE:PRINT "CLSEGA.COM CREATED"
190 DATA B8,12,11,B3,00,CD,10,29,C0,8E,D8,FF,36,87,04,80,1786
200 DATA 0E,87,04,01,B9,00,06,B4,01,CD,10,8F,06,87,04,BA,1221
210 DATA B4,03,B8,14,07,EF,B8,00,06,B7,71,31,C9,BA,4F,2A,1676
220 DATA CD,10,B4,02,30,FF,31,D2,CD,10,CD,20,74,03,C6,07,1747
230 DATA 00,A0,67,46,32,06,69,46,22,C5,22,C1,74,03,C6,07,1346
```

Fig 8 CLSEGA.BAS program to create CLSEGA.COM, which will clear an EGA screen to blue text on a 43-row white background. To patch the colour once you've created the file, change the byte at address 12A

```
          title     curshide

codeseg   segment   byte
          assume    cs:codeseg


curshide proc       far


begin:
          cmp       byte ptr [bx],'0'   ; 0 means hide cursor
          jz        hide_cursor         ; go hide cursor

          cmp       byte ptr [bx],'1'   ; 1 means restore cursor
          jne       err_exit            ; otherwise, parameter error

rest cursor:
          mov       ah,3h               ; read cursor position function
          xor       bh,bh               ; for page 0
          int       10h                 ; video interrupt
          mov       ah,1h               ; set cursor type function
          and       ch, 11011111b       ; bit 5 off turns cursor on
          int       10h                 ; video interrupt
          jmp       short done

hide cursor:
          mov       ah,3h               ; read cursor position function
          xor       bh,bh               ; for page 0
          int       10h                 ; video interrupt
          mov       ah,1h               ; set cursor type function
          or        ch,00100000b        ; bit 5 on turns cursor off
          int       10h                 ; video interrupt
          jmp       short done

err exit:
          push      cs
          pop       ds                  ; ds = cs
          mov       dx,offset err_msg   ; pointer to message
          mov       ah,9h
          int       21h                 ; DOS int 21h function 9h

done:
          ret                           ; return

err_msg   db        0dh,0ah,'CURSHIDE: Bad parameter',0dh,0ah,'$'

curshide endp

codeseg   ends

          end       begin
```

Fig 9 CURSHIDE.BIN, a LOADable binary file to hide and restore the cursor in dBASE III Plus (or any other program that can LOAD and CALL binaries)



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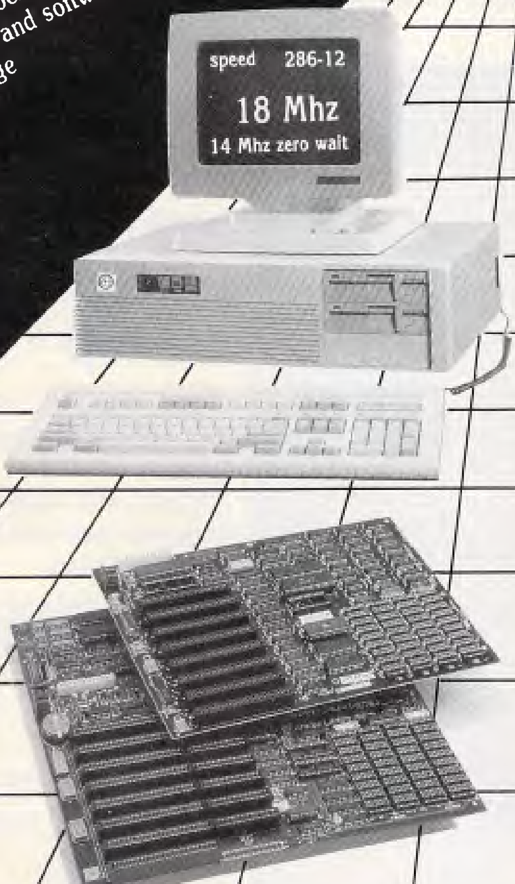

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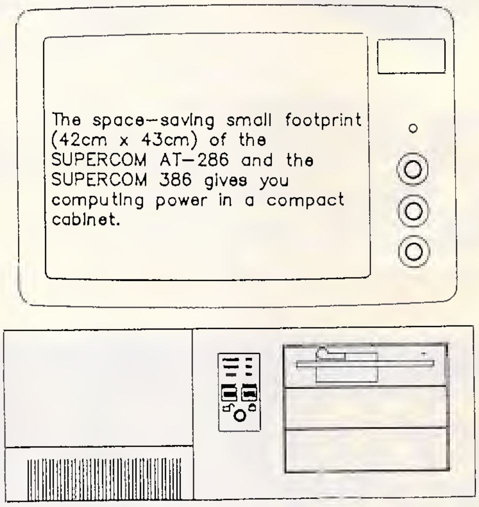

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RS232 revisited

Steve Withers discourses on custom Viatel pages and a 'quiet' change to the serial communications standard in his round-up of this month's communications news.

Did you know that the RS232 standard was redefined at the beginning of last year? The familiar RS232-C standard has been replaced by RS232-D, but the differences between the two revisions are not earth-shattering.

Some of the signal names have been changed, but I'm not convinced that replacing 'Data Set Ready' to 'DCE Ready' is a big improvement. I suppose it does reflect the fact that RS232 is used to connect a variety of equipment, and that a device wired as a DCE (Data Communications Equipment) isn't necessarily a modem.

Pins 9 and 10 are now reserved for testing, and the DB25 connector that we all know and love (but hate to solder) is now a formal part of the standard.

There are a few other minor changes, but the bottom line is that, for most of us, the change will have little effect. However, knowing that differences exist could save a lot of head-scratching if you encounter problems connecting a device built to the new standard.

Viatel

Most of the Viatel subscribers I have met use a fairly small range of the services available. If your videotex terminal software includes redefinable keys, it's easy to get to your favourite services with one or two keystrokes.

For example, I use the Microtex 666 package for the Commodore 64, and pressing the 'Commodore' and 'M' keys takes me straight to Microtex on page 666.

Not all users have this facility, so Telecom has come to the rescue by allowing users to define their own custom menus. You simply fill in a response frame with a list of the menu items and the corresponding page numbers, and Telecom does the rest. You can keep your menu secret, or tell others about it. The only restrictions seem to be the number of items, and the prohibition of obscene language.

System news

Compared with last month's extensive list of updates, my in-tray was looking empty. Fortunately, some news arrived just in time to prevent this being the shortest column since 1894 (when there were barely a dozen boards in the whole country).

Acknowledgements: Brendan Pratt and Rupert Russell.

New listings

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Museum (03) 662 3336. P. Rupert Russell. 24 hours daily. V21, V22, V23, Bell 103 and 212.

Qld

ConComp (07) 857 6000. Viv Brunner. V21, V22, V22bis, V23.

Updates

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Apple-Q Node 2 (07) 800 4660. Kelvin Saggers. 9.30pm-5.30pm weekdays only. V21, V22, V23.

ED (07) 266 3369. MV. Andrew Waddell. 24 hours daily. V21, V22, V22bis, V23. User Works Node 1.

Electric Dreams (07) 399 1322. M. Joe Altoff. V21, V22, V23. User Works Node 5.

Greenhorn Experimental (07) 345 5010. MV. Mike Richardson. 4pm-8am weekdays, 24 hours weekends. V21, V22, V22bis, V23. Previously listed as Greenhorn.

Midnight Express (07) 350 2174. MV. Lloyd Ernst. 24 hours daily. V21, V22, V23.

Sidecar Express (075) 46 3252. MV. Brendan Pratt. 24 hours daily. V21, V22, V22bis, V23, Bell 103 and 212. Previously listed as Sidecar.

Missing Link (07) 808 3094. MV. Mike Barber and Gernot Rosche. V21, V22, V23. User Works Node 3, Punternet Node 7. (Does anyone know the other Punternet systems?)

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Steve Withers, C/- Computer Publications, 47 Glenhuntly Road, Elwood, Vic 3184 or to Viatel mailbox 063000030.

Acknowledgements will normally be made through this column. You may also like to send a copy of the information to the Australian PAMS Coordinator at one of these addresses:

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LAZING AROUND

Brainteasers courtesy of JJ Clessa.

No prizes, no answers for this one.

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- There is an Ace on the right of a Jack.
- There is an Ace on the left of an Ace.
- There is a Diamond on the left of a Heart.
- There is a Diamond on the right of a Diamond.

What is the least number of cards that there could be, and what are they?

Prize puzzle

This shouldn't be too difficult for those of you with micros and a bit of time. In the grid shown, the digits 1-9 are arranged so that the first two rows added together equal the bottom row. Moreover, if the grid is rotated clockwise through 90 degrees, the first two rows still add up to the bottom row.

Can you find another combination of the digits 1-9 which has the same property?

5	8	3
1	4	6
7	2	9

7	1	5
2	4	8
9	6	3

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Send your entry to: Lazing Around March, 124 Castlereagh St, Sydney 2000.

December prize puzzle

Quite a difficult problem — and made impossible if you try to find an integer solution — as some of you did.

One solution (there are others) is:

$$\frac{64}{9} \quad \frac{121}{9} \quad \frac{196}{9}$$

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Meanwhile to all the others — keep trying, it could be your turn next.

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NUMBERS

Mike Mudge moves his 'Number Theory' into the practical world of chess.

This month it is assumed that readers are familiar with the basic modes of travel of Queens, Knights, Rooks and Bishops during a chess game.

The Challenge

The problems to be considered, while soluble with a set of very small positive integers, require considerable 'logic' for their efficient analysis together with ingenuity to display any solutions obtained and, finally, inspiration to find a general algebraic theory to explain what is happening.

Problem 1. How many Queens?

What is the minimum number, f(n), of Queens that can be placed upon an n x n chess board (the standard board being 8 x 8) so that no Queen is guarding (watching) any other Queen, and also so that the entire board is being guarded (watched) by at least one Queen?

Partial solution

n	5	6	7	8	9	10	11	12	13	14	15	16 . . .
f(n)	3	?	?	5	?	?	5	?	?	8	?	? . . .

Problem II. How many pieces?

What is the minimum number of pieces of the same type that can be placed upon a standard (8 x 8) chess board so that every square is guarded (watched) by at least one piece?

Partial solution

Queens

q(8) = 5

Knights

k(8) = 12

Bishops

b(8) = ?

Rooks

r(8) = ?

Note The condition that no piece is guarding any other piece is not part of this problem. It is satisfied by the Queens and Bishops but not by the Knights. What about the Rooks?

Problem III

Extend problems I & II above to a general size of board.

Problem IV

Display the set of all (distinct)* solutions graphically (or algebraically if no suitable graphics are available) at each stage in I, II & III above.

(*Equivalent solutions are related one to another either by a rotation of the board or by reflection in a straight line.)

Problem V

Attempt to construct explicit algebraic formulae for Q(n), q(n), k(n), b(n), or r(n): thereby avoiding the need for the logical analysis used above.

How would the graphical (or algebraic) display be produced if indeed a function value for a given n was known?

Problem VI

Consider the extension of problems I to V to 3D chess.

Readers are invited to send their attempts at some or all of the above problems to Mike Mudge, C/- *Australian Personal Computer,* 124 Castlereagh Street, Sydney 2000, to arrive by 15 April 1988.

It would be appreciated if such submissions contained a brief summary of results obtained in a form suitable for publication in *APC.* These submissions will be judged using subjective criteria, and a prize will be awarded by *APC* to the 'best' contribution received by the closing date.

Please note that submissions can only be returned if a stamped addressed envelope is provided.

Review: September '87

This produced an acceptable spectrum of response. There was general agreement that the complete solution of (i) is given by: 55, 66, 666. The solution sequence for (ii) begins: 1 4, 19600,74909055 . . . for (iii) 1 210, 40755, 7906276, 1533776805 . . . and for (iv) 1, 40755, 1533776805 . . .

Part (v) is fascinating. Using the notation $t_a \pm t_b = t_c t_d$ it is found that:

a 6 18 37 44 86 91 116 132 247 278 392 613 637 662 798 . . .
b 5 14 27 39 65 54 104 125 242 209 374 459 350 275 714 . . .
c 8 23 59 108 106 156 182 346 348 542 766 727 717 1071 1153 . . .
d 3 11 25 20 56 73 51 42 49 183 117 406 532 602 356 . . .

(due to Gareth Suggett).

However, within the spirit of 'Numbers' this month's prizewinner is Martin Sann, who was attracted to the sequence 1, 36, 1225, 41616, 1413721, 48024900, 1631432881, 55420693056, 1882672131025, 63955431761796, 2172602007770041, 73804512832419600 . . . of square numbers which are also triangular.

Martin was predicting that the 15th number in this sequence would appear on his BBC 'sometime early in the 22nd century' . . . only to discover subsequently that Rev Canon DB Eperson (then of Bishop Otter College, Chichester) in *The Mathematical Gazette* (Vol 47, page 237, 1963) provides a simple algorithm for generating terms of this sequence. The observation that only five tetrahedral numbers are also triangular is worth noting, together with the result, first proved by GN Watson in 1918, that only three tetrahedral numbers are also square. What are the numbers referred to in these results?

END

***Mike Mudge** welcomes correspondence on any subject within the areas of number theory and other computational mathematics. Particularly welcome are suggestions, either general or specific, for future Numbers articles; all letters will be answered in due course.*

Isolated readers can be put in contact with others sharing the same interests. However, greater efficiency regarding published problems should result from contacting the prizewinner.

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30 **Productivity Seminar** ACI Computer Services will run a Productivity Seminar in Sydney on March 30. The seminar will address such issues as "Managing to be Productive," software productivity and product demonstrations. *Enquiries, Moira Edwards, tel: (03) 541 5600*

April

5 **Pressed Image Round Table Forum** ENTERPRISE SECURITY — To be held Tuesday, (5pm- 7pm), at Pressed Image. To be discussed; What are the implications for network, data, systems and environmental (physical) security? *Enquiries, tel: (02) 957 2420*

16-21 **Atug '88** Telecommunications — convergence, liberalisation and competition and the quest for the Australian solution. To be held at the Royal Exhibition Buildings, Melbourne. *Aust. Telecomm. Users Group, tel: (008) 22 6281*

18-20 **4GL Symposium** To be held at the Hyatt Kingsgate Hotel in Sydney. *Enquiries, tel: (02) 922 3285*

27-29 **EDP Auditors Association Conference '88** Major topics of this conference include data and physical security, communications, personal computers, networks and system development. *Enquiries, tel: (02) 250 050*

May

16-18 **Microelectronic Advances** Conference to feature microelectronic advances will be held at the University of Sydney. *Inst. Radio & Elect. Engineers, tel: (02) 327 4822*

19-21 **5th World Computer Security Conference** IFIP is expected to draw around 400 international experts on crime and security and will be held on the Gold Coast. Organised by the International Federation for Information Processing. *Bill Caelli, tel: (075) 56 0911*

23-26 **Management Renaissance in a Brave New World** This conference explores the challenges facing managers to the turn of the century and beyond and underlines the key roles managers must play to initiate this renaissance. *AIM, tel: (07) 832 0151*

June

5-9 **The Enterprise Networking Event '88** The Enterprise Networking Event has called a release for papers. The conference is planned for the Baltimore (Maryland) Convention Centre. *Enquiries, tel: (313) 271 1500*

Exhibitions

March

20-23 **PC '88** Organised by Australian Exhibition Services to be held at Darling Harbour Exhibition Centre, Sydney. Also includes Office Technology '88 and Communications '88. *Enquiries, tel: (03) 267 4500*

24-25 **The Australian Computer Recruitment Fair** The fair will be held at Centrepoint Convention Centre, Sydney. The fair will feature 20 leading companies. *Deborah Smith, tel: (03) 267 5600*

28-30 **Cadcam Expo and Workshops '88** To be held at the Observation City Resort Hotel in Perth. *Enquiries, tel: (09) 222 5555*

29-30 **The 2nd National Interactive Video Seminar** Seminar and exhibition to be held in the exhibition centre, Adelaide. *Enquiries, tel: (08) 79 9381*

April

12-15 **Computer '88** Products exhibited will include mainframes, minis and micros as well as software packages, CAD/CAM systems and data communications systems. To be held at the Hong Kong Exhibition Centre, Wanchai. *Enquiries, tel: (062) 917 707*

19-21 **Atug '88** Organised by Riddell Exhibition Promotions. The 5th telecommunications exhibition being held at the Royal Exhibition Buildings in Melbourne. *Enquiries, tel: (03) 429 6088*

21-23 **Nopex '88 Exhibition** For buyers of office products, furniture, office machines and computers. Organised by the National Office Products Association and held at the Royal Exhibition Buildings in Melbourne. *Enquiries, tel: (03) 646 4044*

May

5-7 **Computer '88** More than 50 companies from all over Australia will participate in W.A.'s only computer exhibition. Your chance to view the latest technology. Organised by Swan Exhibitions. *Heather Wheeler, tel: (09) 443 3400*

June

7-10 **2nd Australian Internat. Tech. Exhibition** This exhibition attracts widespread interest in generating business opportunities for 114 participating companies. To be held at Darling Harbour. *Total Concept Exhibitions, tel: (02) 436 3266*

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